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Original Articles.

PRELIMINARY REPORT OF A COMMITTEE APPOINTED BY THE DIRECTOR GENERAL OF THE MEDICAL DEPARTMENT OF THE NAVY IN DECEMBER 1911 TO INQUIRE INTO THE BEST METHOD OF TREATING WOUNDS SUSTAINED IN ACTION ESPECIALLY DURING THE EARLY PERIOD AFTER THEIR INFLICTION

The Committee consists of Sir W. Watson Cheyne, Bt., C.B., F.R.S., Consulting Surgeon R.N.; Fleet Surgeon P. W. Bassett Smith, C.B., R.N.; and Mr. Arthur Edmunds, F.R.C.S., Consulting Surgeon R.N.

The work has been done partly at the Royal Naval Hospital, Chatham, and partly at the Royal Naval College, Greenwich. The committee have to thank the Director General for the cordial support which he has given to the committee in carrying out the research. Surgeon General Johnstone, R.N., in charge of the Royal Naval Hospital, Chatham; Fleet Surgeon Axford, R.N., and Staff Surgeon Minett, R.N., Surgeons to the Hospital; and Staff Surgeon Dudley, R.N., who has charge of the laboratory, for their cordial help. The work is by no means finished as yet, but the Committee feel that, especially in view of the great importance of the subject, the time has come when it is desirable to make a preliminary report of their work.

The chief object of the research was to study the best method of dealing with wounds in the interval between the infliction of the

[illegible] implied the patient to a [illegible] station or to a hospital where the wound could be properly treated at an interval not subsequently [illegible] and bones and sometimes [illegible] of the [illegible] During that time the infection of the wound, which occurred at the time of its infliction and probably increased afterwards by [illegible] with dirt or [illegible] spreads and may become so firmly established that it cannot be eradicated by any means at our disposal The application of a mild dressing over the wound with or without cleansing of the surface of the skin around, can do little or nothing towards checking the spread of infection in the interior of the wound although it may prevent the entrance of fresh infective material On the other hand if some antiseptic substance could be introduced into the wound at the time of or soon after its infliction which was capable of diffusing through the blood clot and tissues and inhibiting the growth of bacteria till such time as thorough disinfection could be carried out a great deal might be gained as regards the prevention or diminution of sepsis and other pathogenic infection

The problem then was to find such a substance which would diffuse in the blood in a wound and the tissues which form its wall and inhibit the growth of the bacteria in the area through which it diffused till such time as the wound can be thoroughly disinfected There are thus two points involved in this problem viz the physical one of diffusion and the bacteriological one of inhibition and it might at first sight seem that each point must be tested separately It is not however so because if a substance diffuses readily, but does not inhibit the growth of bacteria it is useless for our purpose, while on the other hand if a substance which has a powerful inhibitory or antiseptic action on bacteria will not diffuse through blood clot or tissue and still retain that action it is also useless Hence it seemed to us that the simplest way to ascertain what we wanted was to interpose between the chemical substance to be tested and a layer of living bacteria a piece of blood clot or of tissue of a certain thickness say a quarter to half an inch and see whether the subsequent growth of the bacteria was in any way interfered with If it was interfered with then the chemical agent must have been able to diffuse through the intermediate substance and to retain its inhibitory properties, while if on the other hand growth occurred the chemical agent although it might be a powerful antiseptic when in immediate contact with the living bacteria would be of no use for our purpose

The next question was to decide what sort of medium would be most suitable as a basis for the antiseptic, so that it would not escape at once or quickly from the wound, but would remain there for some time and continue to exercise its inhibitory action. It had further to be borne in mind that in a wound we have not only to do with the tissues and a stationary blood-clot, but that serum is constantly being poured out and fresh blood is also escaping, and it is necessary that the antiseptic should remain *in situ* and be in sufficient abundance to impart its inhibitory influence to these constantly changing fluids. Simple fluids of whatever kind would be washed away and would at most only exercise a transitory effect, and it is evident that the chemical substance must be introduced in a more or less solid form and in a medium which will stick about a wound. A powder alone would be inconvenient and possibly also inefficient, because it would be difficult to introduce into the recesses of a deep wound one if introduced, would, like the fluids, tend to be washed out by the blood and serum. And further, the powder might take a considerable time to dissolve in the fluids and we can hardly conceive that these substances can diffuse or act except in solution. Hence we decided to make a sticky paste of some kind either by mixing the antiseptic with some greasy basis or else in the case of powders making a paste with water and some substance such as gum tragacanth which will hold the mass together, inert powder being added if necessary, to give sufficient consistence. If the antiseptics are freely soluble, they diffuse too rapidly and as fresh serum or blood is poured out they are either washed away bodily or are quickly exhausted and no further store is left in the wound. Where however, the antiseptic is not readily soluble, pastes of the latter kind seem likely to answer the purpose very well. In the case of more soluble or entirely liquid antiseptics the combination of the antiseptic with some greasy ointment basis seems, however, to be the most satisfactory arrangement. Most antiseptics can combine with such bases and are not readily washed out as a rule they go on diffusing gradually and in this way a store of the antiseptic is provided which continues to act although a portion may be carried away by the serum which escapes from the wound where a quantity of the antiseptic is thus stored up it may produce its effect for some considerable time. A further point is that a large amount of an antiseptic can thus be introduced into a wound without doing any harm. After making many experiments we have in the latter case used as a base for a good

many of the [illegible] with which sufficient white wax has been [illegible] the necessary solidity the usual proportion being [illegible] parts and [illegible] in one part. *The white wax can be replaced by paraffin, but this substance materially retards the action of the antiseptics.*

We have also considered the strength of these pastes might be used by testing the amount of [illegible] produced by different strengths and also by testing the [illegible] tongue and on the skin.

We have further tested [illegible] certain [illegible] these pastes in wounds in guinea-pigs and [illegible]

Experiments with Blood-clot.

We began by using blood-clot for the purpose of testing these questions of diffusion and inhibitory power of antiseptics, but finding that in a considerable number of cases the result was very much the same with nutrient agar we have also used that material very largely. Ultimately we propose to test all of the antiseptics which seem likely to be of any value in both ways.

As regards blood-clot various methods have been adopted of which the following is the one most frequently employed. The blood is collected at the butcher's, without any precautions against infection, in a long but comparatively narrow jar (3 in. wide) and this is placed in an incubator for some hours. This is usually done at night and next morning a long round clot has separated out from the serum and is turned out on a large flat dish. Two long thin knives are fastened together parallel to each other leaving an interval between the blades of ½ in. With this double-bladed knife the large roll of blood-clot is cut up into a series of discs ½ in. thick. A measured quantity of the paste to be tested is placed on a microscopic cover-glass of a definite size (usually 1 in. in diameter) if in an ointment basis or in a paraffin cell of the same size if in the tragacanth base and this is laid on the bottom of a dish. The disc of blood clot is then placed over this the dish covered and placed in the incubator. As a rule the blood clot is fully contaminated no precautions having been taken to prevent this occurrence but in most cases an emulsion of bacteria (usually *Staphylococcus pyogenes aureus*) has also been brushed over the surface. Observations are made from time to time partly with the naked eye, but also by microscopical examination for bacteria and by cultivation from the surface. Another plan which has also been adopted in some cases is to cut the roll of blood-clot into large

blocks, stand them up in a dish and inject the pastes to be tested into them in various parts as shown in fig 11 In this case also cultivations and microscopical examinations have been made both from the surface and also from the interior of these masses of clot

A few tests have also been made with slices of meat which will be referred to later

Experiments with Nutrient Agar

This medium is more suitable for preliminary work as it is more or less transparent and more accurate observations can be made with it than with blood-clot Hence we have of late used it for the preliminary observations and later have in the case of those substances which we have had time to study more minutely repeated our observations with blood clot in the manner described above The medium which we have used contains 1 per cent agar and Witte's peptone.

We have attempted to make all these experiments under exactly the same conditions When making comparative experiments we always use the same amount of the paste by weight and apply it over the same area of the agar In the case of the ointment pastes we have generally used 1 grm by weight and usually in a 20 per cent strength so that 0 2 grm by weight of the antiseptic has been applied to the under surface of the agar The desired quantity of the paste is weighed out and placed on a microscopic cover glass, 1 in in diameter This is gently heated till the paste melts and forms a uniform convex layer on the surface of the glass when it is allowed to cool again (We are now however, using paraffin cells instead of cover-glasses in all cases The construction and advantages of these will be presently mentioned) A circular slab of agar, 3 in in diameter and $\frac{1}{4}$ in in thickness is then prepared by pouring the liquid agar into a mould designed by Mr Edmunds This mould is made by taking two square pieces of glass a brass ring $\frac{1}{4}$ in thick tocomplete at one part, and three ordinary letter clips One piece of glass sterilized in the flame is laid down on the table, the brass ring is then sterilized in the flame laid on the upper surface of this glass, and then the second piece of glass also sterilized is laid on the top The whole is then bound together by the letter clips as shown in fig 1

Different thicknesses of agar can be obtained by using brass rings of varying thickness The apparatus can also be put together, a little plug of wool placed in the opening in the brass ring and the whole sterilized in the sterilizer but this takes more time The

cell is now suspended (between two test-tube racks is as convenient a way as any) with the opening in the brass ring upwards and liquid agar is poured in till it is half full the agar is then allowed to set The cell is now laid down on one side the clips removed, the upper glass plate lifted off and the cover glass with the paste is laid on the centre of the agar The brass ring is now removed, the lower portion of a large Petri dish placed over the slab and the whole inverted with a little manipulation the agar slab with the paste and cover glass beneath it can be made to drop into the Petri dish An

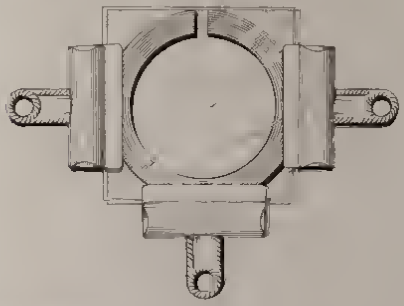


Fig. 1. Diagram of cell.

emulsion of bacteria (we have so far only employed *S. pyogenes* and occasionally we have used *Bacillus subtilis*) which has been prepared beforehand is now brushed over the upper surface of the agar slab and then some liquid agar is poured into the dish around the slab so as to fix it and also to prevent the escape of any gas should the antiseptic tested be volatile Finally the cover is placed on the Petri dish and the whole put in the incubator When a more liquid paste is employed such as that made with tragacanth, it is placed in a paraffin cell 1 cm in diameter instead of one cover glass so as to confine it as far as possible to one limited area of the agar If a liquid alone is to be tested circular layers of filter paper (1 cm in diameter) saturated with the fluid are placed in the paraffin cell The practice with the discs of blood clot has been the same.

The paraffin cells (see fig. 2) are prepared by making holes in a flat sheet of paraffin wax with an ordinary 1-in. punch. It is advisable to work with a uniform thickness of paraffin and we now use a sheet, 1 sq. cm. of which weighs 1 gm. This is readily obtained by melting the wax over water. We take an ordinary flat enamelled photographic dish 13 by 10 cm. size with a surface of 130 sq. cm., to produce the requisite thickness 130 mgm. of wax would be required, but as the sheet is apt to be a little thicker at the edge we allow another 10 per cent. The dish is half filled with water and warmed over a Bunsen burner till the paraffin melts. The flame is then withdrawn and the dish allowed to cool when a uniform sheet of paraffin of the necessary thickness forms on the surface of the water. This sheet is cut into strips

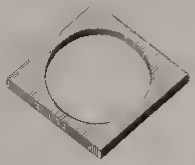


Fig. 2. Paraffin cell.

by scoring it with a knife and breaking it apart. To make the paraffin cells requires a little care. If we attempt to punch them out the sheet is apt to crack, if we do so the punch too much the holes will be too large. The best plan is to let the punch slightly press it against the support but not then push the paraffin through the lumen of the punch with the finger. With a little practice holes an inch in diameter can be made rapidly and accurately. The paraffin from round the edge of the punch is pared off the plate till the paper is exposed at the edge and any roughness is smoothed away with a sharp knife.

This cell is laid on the surface of the agar in the case of the cover glass and the gum of the preparation whatever kind is spread inside the circle. A large square piece of paper is then applied over the opening in the cell and fixed in place by slightly melting the paraffin all round by a warm rod.

After some hours the Petri dish is removed from the incubator

and examined either with the naked eye or with a lens [illegible] bacteria are growing As a rule colonies of bacteria are visible to the naked eye after three hours and with the naked eye after five hours to control plates where no antiseptic is employed growth [illegible] more or less uniformly over the surface of the agar (see fig. [illegible] If, on the other hand, an antiseptic is employed and it is able to diffuse through the agar growth is interfered with over the centre of the plate corresponding to the position of the cover glass or cell behind and over a further area, the whole extent of this area corresponding to the diffusibility and activity of the antiseptic and also to the amount employed and the extent of surface over which it is applied If the antiseptic employed diffuses through the whole thickness of the agar quickly (i e, before colonies have had time to form) and possesses sufficient inhibitory power to prevent growth the area of diffusion is indicated by a clear area on the agar where no colonies are present, this being surrounded by a ring of growth If the substance tested has no antiseptic power or at any rate not sufficient to inhibit growth, or if, possessing antiseptic power, it cannot diffuse, or loses its power in so doing or if it is in too small quantity no such clear area is seen, and it is evident that such substance, at any rate in the strength and medium employed is useless for our purpose All the antiseptics which we have so far tested and which are able to diffuse sufficiently through agar or blood clot to inhibit growth, do so in time to produce a clear area, varying in extent with the nature of the antiseptic its strength and the basis in which it is present These points are being tested with various antiseptics. In the accompanying illustrations examples of the diffusibility and activity of diffusent antiseptics under various conditions will be seen

Further investigations have been made with several antiseptics in order to ascertain whether this clear area simply means inhibition of growth or whether the bacteria also die and over what distance this effect of the antiseptic extends

We have tested a large number of substances as to their diffusibility and activity in relation to agar, but it will be readily understood that these investigations take much time, and we have only as yet been able to study at all thoroughly five antiseptic substances—viz., carbolic acid, cresol, iodine, salicylic acid and double cyanide of mercury and zinc Results have, however, been obtained with other substances which show that they also ought to be studied equally carefully, and this will be done Various side issues, such as the search for more suitable bases the relation of the

PLATE I

[illegible]

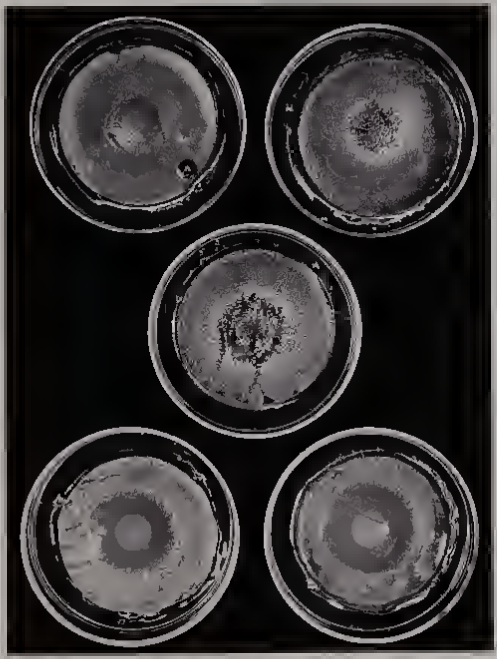
[illegible] forms of [illegible] [illegible] of [illegible] the [illegible] investigation. These [illegible] be continued during the summer, but in the meantime [illegible] the urgency of the matter, it seems well to send in a [illegible] report on the work which we have already done.

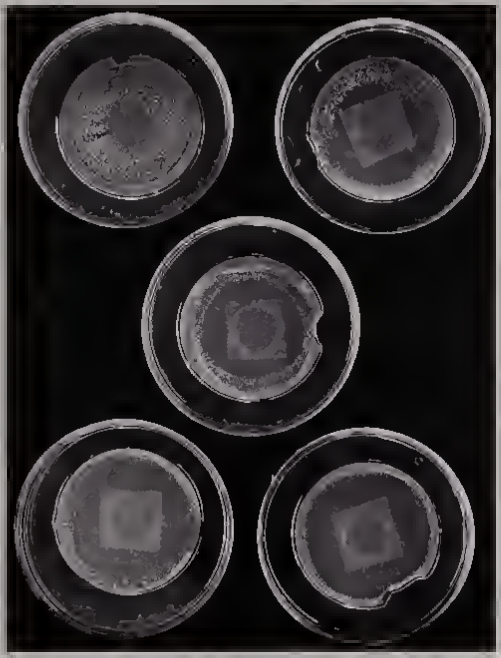
Experiments on Animals.

Experiments have also been made on guinea pigs and rabbits narrated in connection with various antiseptics. It is [illegible] easy to devise experiments corresponding to wounds in [illegible] small animals like guinea pigs the character of the subcutaneous tissues and the whole conditions are very different, and they do not seem to be the same tendency to localization of the lesions as in man. In the case of man the ordinary infections which we have to do with in connection with wounds are essentially local, at any rate in the early stage, and frequently limit themselves to setting up various kinds and degrees of local inflammation, and are thus amenable to local treatment. In guinea pigs the same organisms may rapidly set up a blood disease, so that it is very difficult or impossible to overtake them by local treatment. We shall narrate our experiments so far as they have gone under the head of the various antiseptics.

We have made two sets of experiments the one with non spore-bearing organisms which produce marked local action and the other with the bacilli of tetanus and of acute spreading gangrene. The organisms which we used for the first class of experiments (to illustrate local sepsis such as is produced in man by the various pyogenic cocci) were a particularly virulent strain of *Bacillus pyocyaneus* mixed with a cultivation of *Streptococcus pyogenes*. This caused marked local suppuration and sloughing as well as a general infection of which the control animals died. As regards acute gangrenous processes we obtained cultivations which had originally been derived from the Marne Valley, but the organisms had completely lost their pathogenic properties. The same was the case with various strains of tetanus, but we ultimately obtained through the courtesy of Dr. L. S. Dudgeon a sample of earth which was very rich in *Bacillus aerogenes capsulatus* and the tetanus bacillus both of them in a highly virulent condition. Guinea-pigs infected with this earth died in thirty to forty eight hours with acute hæmorrhagic œdema and inflammation of the parts or if they lived longer they developed tetanus.

PLATE II





carbolic acid was pre... only 1½ gr... The whole of the... the effect seen... As we shall... the antiseptic to varying extents in... with the carbolic acid compari... proportion of the acid in the paste... potent action of the antiseptic.

The effect is still better seen if a larger... over a larger area and for purposes of com... used 1 grm of a 20 per cent paste over an area of 1 in (as in cover-glass or paraffin cell being employed)

Fig 5 illustrates a similar series with 1 grm of the paste over an inch area The strengths being 5 per cent 10 per cent 20 per cent 25 per cent and 30 per cent It will be seen that the increase in the amount of paste used and the increased area to which it has been applied has had a very marked effect on the result The actual measurements of the clear areas are 5 per cent 16 mm 10 per cent 42 7 mm 20 per cent 48 5 mm 25 per cent 57 8 mm and 30 per cent 64 mm

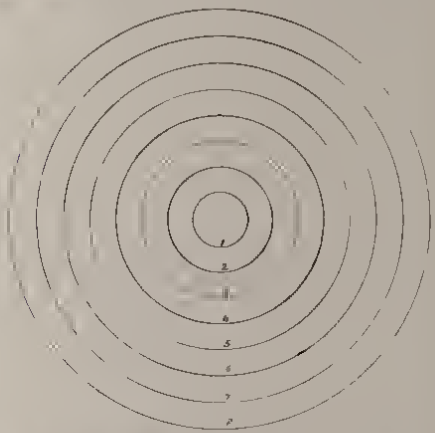
If we now study further one of the higher strengths say 20 per cent carbolic acid (fig 6) we notice not only the extent of the clear area but that the colonies at the margin of that area are smaller than those further out and if we examine the plate with a lens we see still smaller colonies at the outside of the area which to the naked eye appears clear As these colonies do not increase in size after several days in the incubator while those at the margin of the plate do, it is evident that while the antiseptic did not diffuse quickly enough to inhibit the growth of visible colonies outside the clear area it still went on diffusing and inhibited the growth of colonies which had already become visible to the naked eye This point is perhaps best shown in fig 29 (Balsam of Peru)

We estimate the extent of diffusion of 20 per cent carbolic acid in a lanolin and wax base in solid agar in sufficient quantity to inhibit growth in a good deal less than three hours as 11 2 mm and the time inhibitory action as 15 min

A further point of great importance which also must be borne in regard to all these antiseptics, is whether their power is limited to inhibiting all growth or whether the organisms whose growth is inhibited are also killed and if so within what time It will be found that there are considerable differences in this respect between the various antiseptics To test this we have made cultivations from different parts of the surface of these plates at varying periods of time after the commencement of the experiments and in order to have a gauge for comparison we have drawn a series of circles ½ mm apart on the surface of a card these circles being numbered from the centre 1 2, &c (see fig 7) If the lid of the Petri dish is removed and the dish placed on the top of this card so that the cover glass occupies circles 1 and 2 (i e, the centre), the circles can be seen through the agar and a record can be made of the circles from which cultures were taken If the matter were important, smaller circles could be drawn and a still more accurate table could be drawn up but these 6 mm circles give a fair idea of what is occurring In order to save time and material

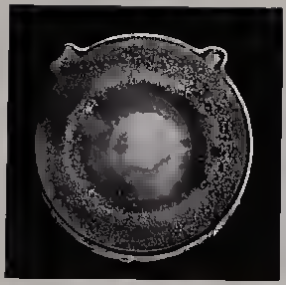
[illegible] we consult [illegible] of platinum wires (6 prongs [illegible] mm apart) [illegible] applied to the surface of the culture [illegible] prong being applied on the edge of the agar slab, and then [illegible] is stroked over fresh agar we get the result as regards growth [illegible] various distances from the centre side by side (see figs 29 and 30)

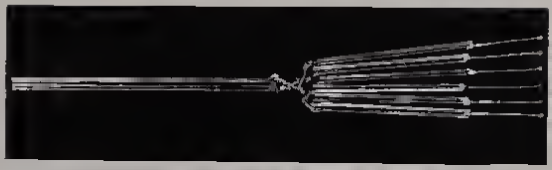
The results as regards carbolic acid are as follows During the first [illegible] hours there is as a rule free growth from all the zones at the



[illegible] part of the plate from which cultivations have been taken

[illegible] the growth from the centre is decidedly less than [illegible] few colonies appearing in the culture and after from [illegible] growth at all is obtained from the centre while only [illegible] obtained from No 3 In twenty four hours No 3 is [illegible] usually No 1 also Hence after the use of 20 per cent [illegible] lin and iodine the bacteria within a range of [illegible] in origin to die within three hours and are all dead [illegible] and thus sterile zone steadily extends for the next [illegible] hours In some cases in cultivations taken from the





[illegible] of three [illegible] actual death [illegible] considerable time must elapse after [illegible] of the antiseptic before they can [illegible] they also lose their virulence [illegible] for a short time in carbolic acid was [illegible] for reducing the virulence of anthrax [illegible] as a vaccine.'

There is one other question which arises with regard to these clear areas, viz., Can bacteria be subsequently grown on them? In one experiment we painted a fresh culture of staphylococci over the clear areas on plates of carbolic acid [illegible] twenty one days after the original experiment, but [illegible] *urmil*

We have also used an emulsion of [illegible] organism—*Bacillus subtilis*—instead of the staphylococci [illegible] with 20 per cent carbolic acid in the lanolin and wax basis and in this also we obtain the same kind of clear area as with the staphylococci [illegible] on cultivation test which we made, twelve and a half hours after the experiment is performed the sub culture from the centre did not grow till after three days and for the first twenty four hours the subculture from No. 3 was not so copious as that from No. 1. Here also apparently the spores took some time to recover from the effect of the antiseptic. We have not yet had time to pursue this matter further with regard to spore bearing organisms.

So far we have been describing results obtained by mixing carbolic acid with a base consisting of 5 parts of lanolin and 1 part of white wax. The amount of diffusibility differs, however very considerably according to the base with which it is combined (see figs. 6 and 9). If for example, the carbolic is combined with ung. paraffini (see fig. 9) or if paraffin is substituted for the wax in the lanolin and wax basis, or if anhydrous lanolin and paraffin are used, the clear area is very much less than that described above, the 20 per cent paste giving a clear space hardly greater than the area to which it is applied, whereas if pure lanolin is used the diffusion is greater than with the lanolin and wax base. When combined with pure lanolin, however the paste is practically liquid and unsuitable for our purpose while it is also much more pungent to the tongue, and therefore probably more irritating to a wound. Undiluted liquid carbolic acid (3 minims on filter paper in a paraffin cell) gives practically a clear slab slight appearance of small colonies being evident at first around the edge but no further growth occurs.

In January last two square flat bottles were sterilized and filled about three quarters full with agar in which a small quantity of an emulsion of *Staphylococcus pyogenes aureus* had been shaken up. Before it solidified a fairly thick glass rod was fixed half way down the centre of each bottle of agar and withdrawn after solidification was complete leaving an open channel. A piece of lint which had not been sterilized was dipped in the emulsion of the cocci and was then pushed down to the bottom of this central canal in each vessel. In one (the control) nothing further was done, but in the case of the other a small quantity of the 20 per cent

carbolic acid paste (as the lanolin and wax base) was injected down this central canal and then the nozzle of the syringe was introduced in four directions into the substance of the agar. The result was that growth occurred in the control vessel while the other remained absolutely sterile.

Similar experiments were performed with gelatine, an emulsion of *Micrococcus prodigiosus* being used, the bottles were not placed in the

b

Fig. 1. [illegible] of growth in gelatine by small [illegible] of earbolic paste [illegible] vessel gelatine quite liquid while the [illegible] line has fallen [illegible] remains solid and unaltered.

incubator but kept in the laboratory at the ordinary temperature (see fig. 10). The control vessel (*a*) showed marked growth; the gelatine became gradually liquefied, and ultimately after six weeks completely liquid and [illegible] in colour while the bottle in to which the paste was injected still remains perfectly clear and solid (*b*).

Experiments with Blood Clot and Animal Tissue

We may [illegible] one or two of our earliest experiments

Experiment I.—(*a*) A piece of blood clot weighing 1 oz. was mixed with 1 dr. of a 10 per cent carbolic paste (in lanolin and wax) and kept in the incubator for twelve days. At the end of that time the clot was quite solid and had no putrid odour but a few long chains and clumps of cocci were found on the surface on microscopical examination no bacilli were seen.

(*b*) Six minims of undiluted carbolic acid were mixed with the same quantity of blood clot and at the end of twelve days the clot was still solid and sweet and no bacteria were found on or in it whether microscopically or by cultivation.

(*c*) A control piece of blood clot with nothing added to it was at the end of the same time a liquid putrid mass and was swarming with bacteria of all kinds.

Experiment II.—A large cylindrical vessel was filled with blood at the slaughter house the blood being taken without any antiseptic precautions. When the vessel was brought to the laboratory it was placed in the incubator overnight and then in the ice chest for four hours. A solid cylinder of clot was thus formed floating in serum. This was turned out on a flat dish the serum drained off and the clot cut into slices like a Swiss roll with an ordinary knife. These slices naturally varied in thickness. A certain amount of the antiseptic to be tested was then placed at the bottom of a Petri dish the sheet of blood clot laid over it, and a little cotton wool packed round the edge to absorb any further serum which might be squeezed out. Although the clot was of course full of bacteria already the surface was inoculated with *Staph. flocceus pyogenes aureus*.

(*a*) In the control dish the blood became liquid and putrid, and was full of organisms of all kinds.

(*b*) In one dish clot 4 mm. thick a small pledget of wool dipped in undiluted carbolic acid was placed in the middle of the Petri dish and the clot laid on it. Here the clot remained sweet and solid and cultivations taken from the surface remained sterile.

(*c*) In another dish some carbolic acid paste (10 per cent.) was used the clot in this case being 8 mm. thick. This also remained sweet and solid, but a few scattered colonies of staphylococci were obtained from the surface on cultivation.

Experiment III.—Similar experiment but the slices of blood clot were of more uniform thickness and the surface was painted with *Bacillus coli communis*. In this case, different strengths of carbolic acid in the lanolin and wax base were tested. Examined after two days with the following result:—

(*a*) Control. Diffluent and stinking and swarming with bacteria.

(*b*) Five per cent carbolic paste. Diffluent except at centre corresponding to the area of the paste where there was a small clear and solid area.

(*c*) Ten per cent carbolic paste. Clear, solid centre (1 in. in diameter) growth elsewhere.

(*d*) Fifteen per cent carbolic paste. Larger clear and solid centre (1½ in.). Colonies at periphery. No organisms found by microscope or cultivation over the clear area.

—) 1 in 20 per cent carbolic paste. Clear and solid centre (no [illegible] all colonies outside. No organisms over clear area (microscopic and cultivation).

Since that time we have worked out the more precise methods referred to before: the double bladed knife giving a constant thickness of clot, the exact quantity of paste on cover glasses or in paraffin cells and so on, and our results with blood clot correspond in every particular with those obtained with agar and the further experiments need not therefore be detailed.

Experiments with Animal Tissues

(1) A slice of fresh beef about ¼ in. thick was obtained from a butcher's shop and was laid over an inch cover glass on the surface of which was 1 grm. of the 20 per cent carbolic paste (lanolin and wax base) and placed in the incubator. An area of the meat corresponding to one and a half times the diameter of the cover-glass remained sweet and unaltered while the surrounding part of the meat putrefied.

(2) A guinea pig was killed in the laboratory. We cut away the side of the thorax (ribs and soft parts), forming a circle about 2 in. in diameter. This was placed in a Petri dish over a cover glass with 1 grm. of 20 per cent carbolic paste. Quite a thin layer of agar was run over this so as to enable us to see colonies (if they grew) and when this had solidified the surface was painted over with an emulsion of *S. pyogenes aureus*. No growth occurred except quite at the edge and the tissues in the central area remained apparently unaltered.

Experiments on Guinea pigs.

A.—Experiments with non spore bearing organisms a mixture of virulent Bacillus pyocyaneus and Staphylococcus pyogenes.

(1) Control. A small square of lint was soaked in a strong emulsion of these organisms and introduced into a wound in the subcutaneous, and slightly also the muscular tissue over the shoulder (in this plan the fluid which is squeezed out of the lint tends to run under the skin for a considerable distance and is not confined by fat and fascia as in man it also escapes on to the surface of the skin). The wound was stitched up. The operation was followed by severe suppuration: the animal rapidly lost weight and was killed in seven days. *B. pyocyaneus* was present in the wound.

(2) Lint introduced into a wound as above and carbolic acid paste (30 per cent.) squeezed into the wound *immediately afterwards*: the wound was then closed by stitches. No local symptoms for four days and the animal gained weight. The animal then began to lose weight slightly and a little suppuration occurred. The wound was opened and cleaned out, the piece of lint being removed: the animal rapidly got well. No *B. pyocyaneus* found in the wound.

(3) Carbolic paste (30 per cent.) introduced *fifteen minutes* after infection. Gained weight and no suppuration for four days, then slight suppuration but no *B. pyocyaneus* found. Recovered.

(4) Carbolic acid paste introduced *half an hour* after infection. Rapid

loss of weight, suppuration and necrosis. Anaërobic bacilli were found.

It appears, therefore, that up to fifteen minutes the carbolic paste is able to diffuse in the wound in the guinea pig, and destroy the bacteria or inhibit their action for four days. After this time the organisms seem to have got beyond the reach of the paste.

B.—*Experiments with earth containing Bacillus aerogenes capsulatus and tetanus bacilli.*

With the view of ascertaining the average lethal dose of this earth various experiments were done which showed that 0·2 grm. was always lethal. They further showed that carbolic acid did not injure the animals, nor did it cause a non-lethal dose of the earth to become lethal. For example, 0·023 grm. of this earth was introduced under the skin, and fifteen minutes later 20 per cent. carbolic acid paste. No effect. Similarly there was no effect if the carbolic acid paste was introduced five minutes after infection with this quantity of earth. Undiluted liquid carbolic acid applied to wounds in guinea pigs (three cases) caused (1) increased flow of blood, (2) frequent micturition, and (3) slight twitching of limbs, but this quickly passed off, and the wounds healed rapidly.

(I) The earth was made up into a liquid mud with which small squares of lint were infected which were introduced under the skin and at various periods of time afterwards the carbolic paste was introduced.

(*a*) Control. Died in seventy-two hours; extensive hæmorrhagic œdema and gangrene. *B. aerogenes capsulatus* isolated.

(*b*) Thirty per cent. carbolic acid paste introduced into the wound *immediately* after the lint was put in. Died of tetanus on the fourth day. No marked local disturbance.

(*c*) Thirty per cent. carbolic paste introduced *fifteen minutes* after infection. Died in seventy-two hours. No abscess or pus; slight œdema. Obtained *B. aerogenes capsulatus* on cultivation in smear; both *B. aerogenes capsulatus* and *B. tetanus*.

(*d*) Thirty per cent. carbolic paste introduced *thirty minutes* after infection. Died of tetanus on eighth day. Tetanus bacillus found in the wound but no *B. aerogenes capsulatus*.

(II) 0·25 grm. of earth was placed in a gelatine capsule and introduced into a subcutaneous wound. This was done in order to avoid infection of the skin, and the gelatine capsule dissolves and liberates the earth almost at once.

(*a*) Control. Animal died with diffuse hæmorrhagic œdema in thirty-six hours.

(*b*) Thirty per cent. carbolic acid paste introduced *five minutes* after infection. Died of acute hæmorrhagic œdema in forty-eight hours.

(*c*) Thirty per cent. carbolic acid paste introduced *five minutes* after infection. Four hours later 200 units of antitetanic serum were injected. After forty-eight hours the wound was swabbed out with 1 in 20 carbolic lotion, and this was done every day afterwards. Recovered.

(*d*) Thirty per cent. carbolic acid paste introduced *fifteen minutes*

1

after infection [illegible] forty eight hours with spreading œdema *B aerogenes capsulatus* and *B tetani* found in serum

(*b*) Thirty per cent carbolic acid paste introduced *fifteen minutes* after infection Four hours later 200 units of antitetanus serum After forty-eight hours wound swabbed out with peroxide of hydrogen Died on fourth day Hæmorrhagic œdema *B aerogenes capsulatus* cultivated

It will be noted that the only animal which recovered was one in which antitetanus serum had also been administered and the wound cleaned out after forty eight hours In the first set of experiments it looked as if the anaerobiotic process had been stopped, but the second series does not confirm this idea

Observations on Man

Up to the present we have had very few opportunities of making observations on men There have been no naval wounded for several weeks and dockyard and ship accidents have been much fewer than they were Two cases have been mentioned in the *Lancet* for February 27 p 429 One was a compound wound of the interphalangeal joint of the thumb It was a machinery accident with much soiling of the wound A 20 per cent carbolic acid paste was at once squeezed into the wound from a paint tube, and from time to time some more was applied on the surface The interesting point of this case was that although the skin had never been cleaned up or the wound cleaned out, and although practically the entire terminal phalanx was dead, yet for ten days there was no local or general disturbance and no fever no pain swelling or suppuration On the tenth day the surgeon cleaned it out and applied ordinary dressings Two days later sepsis appeared with suppuration up the tendon sheath, just what ought to have been present ten days earlier

Another case was an accidental pistol wound of the buttock with fairly large entrance and exit openings Carbolic acid paste (20 per cent) was freely introduced and no inflammation occurred along the track of the wound, and ultimately there was only a small granulating sore at one of the openings, which healed in a few days

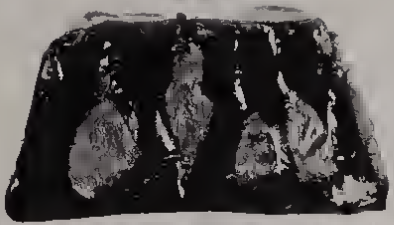
A third case was a bad scalp wound with denuded bone which was filled up with a 20 per cent carbolic acid paste Here also there was no disturbance and after ten days the small sore which remained was dressed with weak boracic ointment.

Tests have been made as to the effect of these pastes on the skin A 10 per cent carbolic acid paste causes a little redness and slight swelling of the skin after twenty four hours but a 20 per cent strength does not seem to affect the skin In the cases above referred to no irritation of the skin was produced

Cresylic Acid (Cresol)

This is a product of distillation of coal tar, and consists of three isomeric bodies ortho , meta and para cresol, which have nearly the same boiling point, hence the German name Trikresol Impure carbolic acid contains cresol, and it is the active agent in various proprietary substances which are a good deal employed in surgical practice Cresol is said to be more active than carbolic acid but less irritating and less poisonous It seems doubtful, however, if there is any marked difference between the two

PLATE I.



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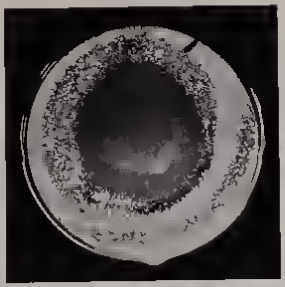

We have worked with the redistilled ortho-, meta- and para-cresol obtained from Mr. Martindale, and have also tested some of the proprietary substances. We have tested carbolic acid and cresol side by side and it is difficult to find any definite difference between them as regards diffusibility or antiseptic action. If anything it seems to us that cresol is rather more active than carbolic acid: the clear area seems to be rather larger and the area in which death occurs slightly greater. All the points which have been tested with carbolic acid have also been tested at the same time with cresol, both with agar and with blood clot: and seeing that the results are practically identical it does not seem necessary to repeat what has already been said.

We have, however, attempted to imitate the conditions of a wound and fig. 11 illustrates one of these experiments. A large block of blood clot was placed in a glass vessel and by means of a syringe four small collections of the 20 per cent. cresol paste were introduced into the substance of the clot, about ½ in. apart. The vessel was covered over and placed in an incubator for some days. At the end of a week the clot remained solid and still unaltered and a section was made through the middle of it. The figure represents the appearance of the cut surface of the section. The four pieces of paste are seen with the tracks of the syringe and the solidity of the clot is apparent. Microscopical examination and cultivation from various parts of the cut surface failed to show any bacteria.

Figs. 12 and 13 show the extent of the clear circle with cresol, 20 per cent. and 30 per cent. respectively.

We may, however, record the results of the experiments on animals.

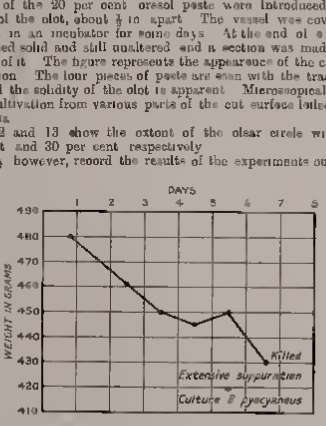

Chart I.—Control guinea pig inoculated with infected lint.

A.—*Cresol and non spore bearing organisms (Bacillus pyocyaneus and Streptococcus pyogenes).*

Series I.—(1) Control. Small square of lint soaked in a strong emulsion of these organisms and placed under the skin of the shoulder. Severe suppuration: animal killed in seven days. *B. pyocyaneus* present in the wound. (Chart I. gives the variations in weight.)

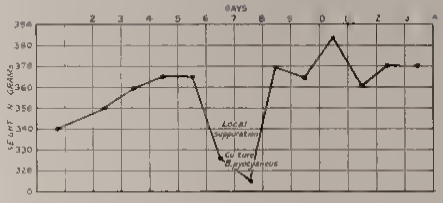

CHART 2 Guinea pig inoculated with infected lint, and 30 per cent cresol paste applied at once

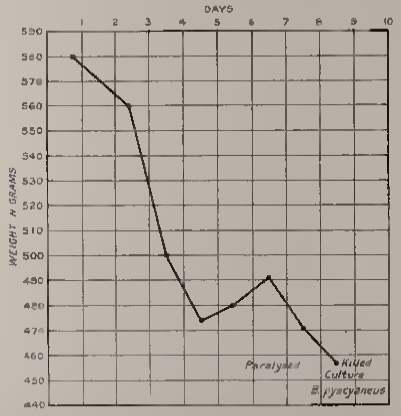

CHART 3 Guinea pig inoculated with infected lint and in half an hour treated with 30 per cent. cresol

(2) Cresol paste (30 per cent.) introduced ... around ... after injection with lint as in control—wound stitched up. No suppuration for four days and the animal gained weight; then began to lose weight, and slight suppuration occurred. Wound opened and cleaned out and lint removed. Rapidly recovered. *B. pyocyaneus* found in the wound. (Chart 2 gives the variations in weight.)

(3) Cresol paste (30 per cent.) introduced *fifteen minutes* after injection. Almost continuous gain in weight; no suppuration for four days. Recovered. *B. pyocyaneus* not found in wound.

(4) Cresol paste (30 per cent.) introduced *half an hour* after injection. Rapid loss of weight, suppuration and necrosis. Animal killed. *B. pyocyaneus* found. (Chart 3 gives the variations in weight.)

Series II.—The *B. pyocyaneus* and *Staphylococcus pyogenes aureus*, instead of being introduced on a piece of lint, were made into a paste with starch and placed in a small gelatine capsule, the main object being not to soil the skin and cellular tissue except at the seat of experiment.

(1) Control. Suppuration and secondary abscess in neck. Killed.

(2) Cresol paste (30 per cent.) introduced *immediately* after injection. No suppuration or sloughing, but small sore at seat of opening took some time to heal. Recovered.

(3) Cresol paste (30 per cent.) applied *ten minutes* after injection. No suppuration. Small sore at line of incision. No *B. pyocyaneus* found. Recovered.

(4) Cresol paste (30 per cent.) applied fifteen minutes after injection. No suppuration. Small dry sore. No *B. pyocyaneus* found. Recovered.

Hence the results with the non-spore bearing organisms are quite good up to fifteen minutes after injection.

B.—*Experiments with cresol paste and spore bearing organisms (tetanus and spreading gangrene) in earth.*

Series I.—See carbolic acid (B. I.). (1) Control. Lint dipped in the mud containing *B. tetanus* and *B. aerogenes capsulatus* introduced under skin. Died in seventy-two hours. Extensive hæmorrhagic œdema and gangrene.

(2) Cresol paste (30 per cent.) introduced *two hours* after inoculation. Died of tetanus on fourth day. No suppuration, slight œdema.

(3) Cresol paste (30 per cent.) introduced *fifteen minutes* after infection (the lint with the greater part of the mud had apparently escaped from the wound in the interval between the infection and the introduction of the paste). Recovered without any bad symptoms.

(4) Cresol paste (30 per cent.) introduced *thirty minutes* after infection (here the lint fell out when putting in the cresol). Recovered.

(5) Cresol paste mixed with earth (0·2 grm.) and introduced into the wounds. Animal recovered.

Series II. (1) Control. 0·25 grm. of earth placed in a gelatine capsule and introduced into the subcutaneous wound (see Carbolic acid). Died with diffuse hæmorrhagic œdema in thirty-six hours.

(2) Cresol paste (30 per cent.) introduced *fifteen minutes* after infection. Animal died of hæmorrhagic œdema in forty-eight hours.

(3) Cresol paste (30 per cent.) introduced *fifteen minutes* after infection and then antitetanic serum four hours later. After twenty

lor—home wound swabbed out with 1 in 20 carbolic acid and packed with more paste. Recovered.

The object of this last procedure is to do what is proposed in wounds. If cresol were used alone the idea would be, on the reception of the wound to introduce the paste then as soon as possible give a dose of antitetanus serum and on arrival at the base clean out the wound and introduce more paste. Looking at the carbolic and cresol cases together this seems to have been successful except in one case.

As regards the two which recovered without serum in both cases the piece of bone had fallen out from a quarter to half an hour after injection. Here, however, a quantity of mud was left behind in the wound, and either the dose of bacteria was too small or else the growth of the bacteria had been arrested probably the former.

Observations on Man.

On the skin cresol is rather more irritating than carbolic acid. As to the action of the paste in wounds we have had only one really test case: that of a man who shot himself in the face and head the bullet entered just in front of the mastoid process and ran upwards and forwards and came out at the inner side of the forehead near the middle line. In its course it broke up the upper jaw and the malar bone, passed through the eyeball tearing it to tatters and smashed up the lower and anterior walls of the frontal sinus. The fracture of the frontal bone extended into the nose, where also the dura mater was torn, but there were no cerebral symptoms at first. The remains of the eyeball were removed and also one small quite loose fragment of bone from the supra orbital region. The 20 per cent cresol paste was then freely introduced into the whole track and cavity of the wound. The patient lived four days and died of his intracranial injuries, but during that time there was no inflammation of sloughing or suppuration from the wounds: they were quite aseptic, and no bacteria could be found in pieces of blood clot examined on the second and third days. On the second day a tuberculin was made from the end of the drainage tube where it projected beyond the wound and only six colonies of cocci were obtained. Naturally one would have expected some growth from that part, and it is surprising that it was so little. The patient developed symptoms of meningitis and died on the fourth day. On post-mortem examination suppurative meningitis was found, but there was no suppuration anywhere in the external wound where the paste had been introduced, indeed although it communicated with the tear in the dura mater the blood clot was lying in it without any decomposition.

In connexion with cresol we may refer to certain proprietary substances which are a good deal used by surgeons and the chief active agent in which is cresol. These are Izal, Cyllin, Hycol, Pacolol and Lysol.

Izal.—The only test we have so far applied to this substance is the action of a 20 per cent paste (lanolin and wax base) as contrasted with pastes of other antiseptics of similar strengths. The result is that no clear area is formed beyond the limit of the cover glass, in fact colonies are seen extending further inwards. Diameter of absolute clear area 30 mm. (see fig. 14).

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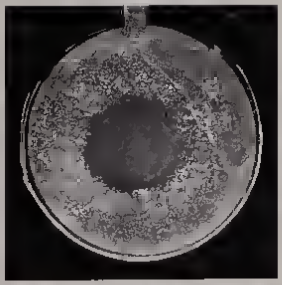

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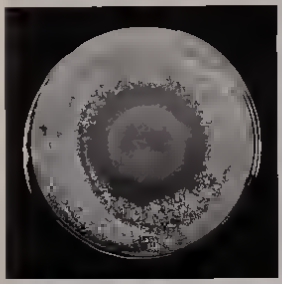
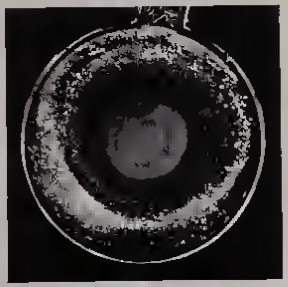


[illegible] equall 20 per cent [illegible] and wax base.



[illegible]

[illegible] —In a 20 per cent paste there is a somewhat larger clear area [illegible] with rapid but isolated colonies formed up to the edge of the cover [illegible] Diameter of absolute clear area = 24 mm (fig 15)

Lysol —The 20 per cent paste gives a large clear area with a diameter of about 37 mm (fig 16)

British Lysol —Made by Martindale with redistilled O M P cresol (ortho- meta- and para- cresol) gave a large clear area with a 20 per cent paste with diameter about 45 mm (This British lysol contains 50 per cent O M P cresol) (See fig 17) Fig 18 shows the result with British lysol pure on filter paper

Hycol —In a 20 per cent paste gives a clear area with a diameter of about 25 mm As this was the first cresol preparation we tested we made further experiments with it For example we compared a series of pastes of different strengths with carbolic acid as regards their power of killing bacteria on the surface of the agar block These plates, prepared with pastes of 5 per cent 10 per cent 15 per cent and 20 per cent of each were tested at the end of twenty four hours as to the vitality of the bacteria in the centre with the following result (*Staphylococcus pyogenes aureus* being used) —

	5 per cent	10 per cent	15 per cent	20 per cent
Carbolic acid	+			–
Hycol	+	+	+	–

An experiment with blood clot planted with *B coli communis* (part of experiment with carbolic acid, p 117) gave the following result —

Hycol 5 per cent —Clot diffluent stinking and full of bacteria

Hycol 10 per cent —The same

Hycol 15 per cent —Clot not so decomposed but full of organisms

Hycol, 20 per cent —Small clear centre but plentiful growth around Microscopically some bacilli but chiefly cocci in large numbers Growth on cultivation from centre

In again Experiment I with carbolic acid (p 117) is referred to, other antiseptics were tested at the same time and in the same manner and the result with Lysol 15 per cent was considerable decomposition of the blood which was semi liquid and contained bacilli and cocci in large numbers

With hycol (20 per cent) the clot remained solid and was not smelling but bacilli and cocci were growing on it

Lastly in Experiment II with carbolic acid (p 117) hycol was tested in 15 per cent and 20 per cent strength but though there was no putridity and the clot remained fairly firm, especially the 20 per cent one, there was plentiful growth of cocci on the surface

The same firm has on the market another preparation termed *Pacalol*, which was also tested at the same time

In Experiment I (see above) a 5 per cent pacolol did not interfere with the decomposition of the blood and the growth of bacteria nor did

the undiluted pacolol itself and the same was the result with a 5 per cent pacolol in Experiment II.

With the exception of the lysol emulsion by Martindale with redistilled cresol none of these preparations are so satisfactory as the pure cresol or carbolic acid.

Iodine.

Experiments with Agar.—Iodine in the lanolin and wax base in the proportions of 2 per cent. 4 per cent. and 6 per cent. did not interfere with growth on the surface of the agar slant at all. As each of these strengths caused redness and irritation of the skin if kept on for twenty-four hours and as a 10 per cent. paste rapidly caused necrosis of the skin after two and a half hours application we did not consider it necessary to make any stronger pastes. It is curious to note in the 6 per cent. paste (fig. 19) that the organisms are grown more copiously over the iodine than elsewhere although this is the thickest portion of the slab.

Thinking that the addition of iodide of potassium might help the diffusion of the iodine a fresh paste was prepared with 2 per cent. iodine and 3 per cent. iodide of potassium, but the bacteria grew on the surface as freely as before. A 3 per cent. potassium iodide paste alone does not interfere with growth. Tinct. iodin. (*B. P.*) was dropped on filter paper in a Petri dish cell, but it also did not inhibit growth. The colonies were somewhat sparser over the actual central part, but there was no real check but on. There was no discoloration of starch on the surface of a plate in which tinct. iodin.

Inoculation of tubes from the centre of a 6 per cent. plate six days after this preparation gave copious growth.

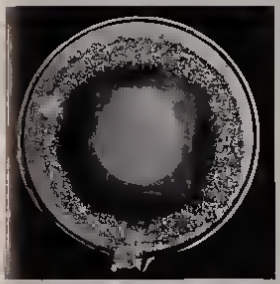
Experiments with Blood.—In blood iodine is also equally inert. In one experiment cultivated 20 per cent. cresol 10 per cent. and iodine 6 per cent. in pastes were placed behind films of blood ⅛ in. in thickness, and the surface of the clot was brushed over with a culture of *S. pyogenes* aureus. While the two former checked growth and prevented decomposition and diffusion of the blood growth occurred freely with the iodine and the clot broke down and became diffluent. In another experiment blotting paper was saturated with a 2½ per cent. iodine solution and placed over a cell behind a disc of blood clot the surface of which was painted with *B. coli communis*. The clot became stinking and diffluent.

No experiments have been made on animals, because iodine was being extensively used at the time. The application causes great pain and it seems amply proved that it does not disinfect the wounds. Indeed many of the wounds which have been treated with iodine are among the most septic which we meet with. It is quite clear from all these facts that iodine is useless for the disinfection of wounds in war or for inhibiting the growth of bacteria in wounds.

Double Cyanide of Mercury and Zinc.

This salt was introduced into surgical practice by Lord Lister, in 1889 and was the subject of several very interesting communications by him. It is a peculiar substance and does not seem to be always quite constant, while it may contain some free salt especially a mercurial salt which may cause a good deal of irritation. Lister states that when quite pure it

PLATE VII.



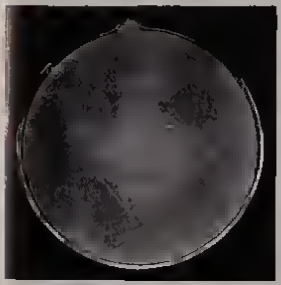
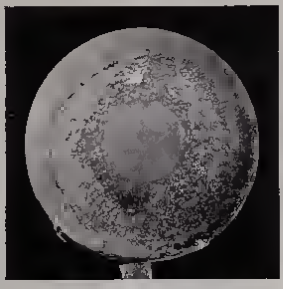


Fig. 10.—Double ... water ...



... 9.—Salicyl... wax base

is insoluble in water, but soluble in 1—3,000 parts of blood serum so that it does not irritate the skin. Of late, however with the specimens of this salt supplied to us we have been able to dissolve a certain amount of strongly antiseptic salt from the powder in water and some samples of cyanide gauze which we have come across of late cause marked irritation of the skin in a manner of which we have had no previous experience; and one cannot help thinking that possibly some alteration has been made in the process of manufacture of late, which leaves a certain amount of soluble salt mixed with the double cyanide and that in this is irritating to the skin and may also be poisonous.

Experiments with Iris.—The powder of the double cyanide was rubbed into a 10 per cent. paste with the lanolin and wax base and on agar plates prepared in the usual manner. Free growth occurred though the colonies over the centre were not quite so numerous as elsewhere. On the other hand when the powder was mixed with a little water and placed in a paraffin cell no growth occurred anywhere over the agar plate (see fig. 20). This last experiment was repeated several times always with the same result; in one plate there was a very narrow line of small colonies quite at the outside of the plate but the others showed no growth at all.

This result was very surprising. It is difficult to understand how a powder which is said to be practically insoluble in water could diffuse over a disc of agar 3 in. in diameter and $\frac{1}{4}$ in. thick and also exert not only an inhibitory but also an antiseptic action for examination of the surface of the plate showed that the bacteria towards the centre were killed. Either the combination had become dissociated and we had the cyanide of mercury and the cyanide of zinc separate or some free salt (? cyanide of mercury) has been left in the powder during its preparation, &c. Lister speaks of a free soluble salt being sometimes present in the double cyanide which irritates the skin.

We tested rosaline, the colouring matter used in the cyanide gauze and we found that it gave a clear space 6·3 mm. in extent so that it is itself an inhibitory and antiseptic agent.

We have washed the powder of the double cyanide in several changes of water and dried the powder again. It still inhibited all growth on the plate.

On leaving some water over the cyanide powder and then filtering it we found that the water in the proportion of one part to three parts of nutrient broth prevented growth of staphylococci so that it evidently had dissolved out some substance which was antiseptic. This water showed the presence of a mercurial salt.

Cyanide of mercury is a powerful antiseptic and plates prepared with this substance showed no growth just like the ones with the double cyanide. Cyanide of zinc and cyanide of lead also give the same result but cyanide of lead leaves a narrow margin of growth.

Experiments with Blood.—A stoppered bottle was half filled with blood clot and a quantity of double cyanide powder which had been washed in several changes of water was mixed up with it. The clot remained firm and did not undergo putrefaction. Some double cyanide powder was placed beneath a disc of blood clot which was inoculated on the surface with *B. coli communis*. Small clear centre marked growth and liquefaction and putrid smell at the margin.

Cyanide paste which had been kept in a lead tube for some time and had corroded the lead and probably formed cyanide of lead placed under a disc of blood-clot which was inoculated with *B. coli communis* gave a clear centre of an inch in diameter but marked growth at the margin

Experiments on Guinea pigs.—(1) Gut infected with very virulent mud (full of *B. tetanus* and *B. aerogenes capsulatus*) introduced into a wound and double cyanide paste five minutes later. Died in forty eight hours symptoms of tetanus. *B. aerogenes capsulatus* obtained from serum (2) 0·1 gram earth in capsule and cyanide paste fifteen minutes later. Ill all after two hours and died in forty hours. No marked inflammation or oedema no *B. aerogenes capsulatus* obtained from near the wound (3) Similar experiment very ill from first slight redness round wound, [illegible] passed. Died in fifty six hours. *B. aerogenes capsulatus* obtained from wound. (4) Similar experiment + anti tetanic serum in fourteen hours. Died in eighteen hours. Ill soon after inoculation, never ate or moved. No oedema. No *B. aerogenes capsulatus* found

The impression which we obtained from these experiments was that the death of the animals was due to poisoning rather than to tetanus or the gangrenous process and till we have got a little more light on the chemistry of the substance we should hesitate to leave any considerable amount of this salt in a wound

Salicylic Acid and Salicylates

Salicylic acid was introduced in the treatment of wounds by Professor Thiersch of Leipzig about forty years ago, and extensively used for some time. It was the most successful substitute for carbolic acid at that time but was gradually given up as the results obtained were not so good as with carbolic acid. It was used in the form of lotions, cream, ointment gauze and wool, and up to the present time some surgeons employ salicylic wool as an outside dressing to reinforce the antiseptic gauze especially if there is likely to be much oozing of blood or serum. At one time a salicylic cream was much used by Lister for applying on the skin around the wound where a dressing was to be left on for some days. It seemed to prevent the irritation of the carbolic dressings and also the growth of bacteria on the surface of the skin and thus [illegible] wounds. This cream was made by mixing salicylic acid powder with glycerine (containing 1 per cent. of carbolic acid) till a suitable consistence was obtained.

In the Russo Japanese War the Japanese used a powder of salicylic acid and borax with which they dusted the wounds as soon as possible after their infliction, and they regarded this method with favour. Some time ago Fleet Surgeon Gaskell who is in medical charge of the Naval Division arranged when preparing the medical outfit of that division to include in the first field dressing packets a dredger containing a powder of borax and salicylic acid in equal parts with which to dust the wounds.

Salicylic acid is soluble in 1 in 550 parts of cold water in 1 in 11 parts of alcohol (60 per cent.) and in 1 in 150 parts of glycerine and its solubility in water is much increased by the addition of borax. Twenty grains of salicylic acid are rendered soluble in 1 oz. of water by the addition of 20 grs. of borax. We have found that its activity as an antiseptic is increased by the use of boric acid and from our experience

PLATE VIII

we prefer this to borax We have termed the mixture of boric and salicylic acids "borsal" for the sake of shortness

Experiments with Nutrient Agar —Salicylic acid (20 per cent) in the lanolin and wax gives a small clear area about 24 mm in diameter (see fig 21). When compared with its action in the gum tragacanth base this is quite insignificant, and we have not therefore done any more work with the lanolin and wax base

Salicylic acid in a gum tragacanth base (salicylic acid 40 parts, gum tragacanth 2 parts, glycerine 29 parts, water 29 parts) gives a clear area 44 mm in diameter (see fig 23)

We have done a considerable number of experiments with salicylic acid and boric acid (borsal) in various proportions in the gum tragacanth base above mentioned the total quantity of powder being in all cases 40 per cent The clear area is large in all cases (averaging 58 mm in diameter) and practically of the same extent although the proportions of the two substances varies (see figs 23 24 and 25) Boric acid alone in the gum tragacanth base gives a clear area 44 mm in diameter (see fig 26) Salicylic and borax in equal parts in the same base gives a clear area 66 mm in diameter (see fig 27) Borax alone under the same conditions gives a clear area of 46 mm (see fig 28)

The following table shows the action of the above substances in the gum tragacanth base as regards inhibition —

	Clear area (i e inhibition) in each
Salicylic acid	44 mm
Boric acid	57 mm
Borax	46 mm
Borsal	58 mm
Salicylic acid and borax	66 mm

Still more important than the inhibition is the question of the death of the bacteria We have tested borsal at various intervals during the first twenty four hours by the trident method already described and the others have been tested at the end of twenty four hours

The following table shows the result as regards borsal at various intervals during the first twenty four hours —

Areas	1	2	3	4	5	6[1]
After 2 hours	–	–	+	+	+	+
4	–	–	+	+	+	+
1		–	–	r		+
8					r	r
10	–	–	–		+	+
14					+	+

[1] See card (fig 7) Retarded growth

The next table gives the result in the following cases at the end of five forty four hours —

Area	1	2	3	4	5	6
Boracic					—	
Boric acid		—	—	+	—	
Borax	+	—	+	—	—	
Salicylic acid and borax (equal parts)				+		

Seeding 4.0 Seeding 30

As regards salicylates the following were tested in 20 per cent strengths in the gum tragacanth base slightly more gum being used to give sufficient solidity

	Inhibition area 39 mm
Salicylate of quinine	
,, soda	,, ,, 58 ,, (Fig. 11)
,, ammonia	,, ,, 36 ,, (Fig. 12)

With none of these substances were the organisms killed at the end of twenty four hours even at the centre

It is interesting to note that on the salicylate of quinine plate *Aspergillus niger* grew on the clear area after several days, although there was no extension of the staphylococcus growth

Experiments with Blood — When mixed with blood salicylic acid causes the dark blood clot to become red Placed under a slab in the manner already described the salicylic tragacanth paste gave a clear area corresponding to the extent of the paste, and the surface was sterile after twenty four hours A thick cake of blood was injected with the paste in various places (see carbolic and cresol experiments) and remained sweet for several days It did not become hard as it does with the carbolic acid

Experiments on Guinea Pigs

I —*Experiments with Bacillus pyocyaneus and Staphylococcus pyogenes aureus to test local application, in powder of equal parts of salicylic acid and boracic acid, mixed with starch*

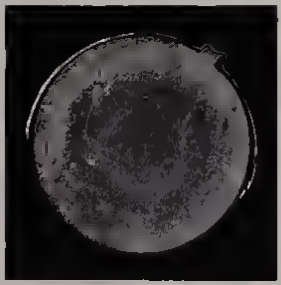
1 —

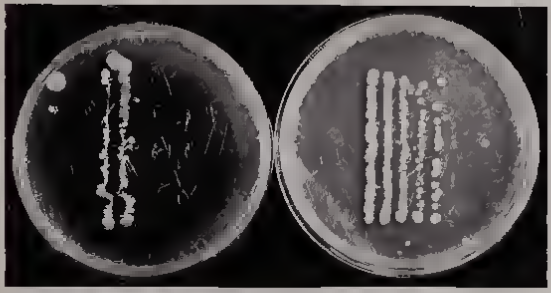
(1) Control Cultivation mixed with starch and put in a capsule Slight suppuration *B. pyocyaneus* obtained from the wound on the fourth day Recovered

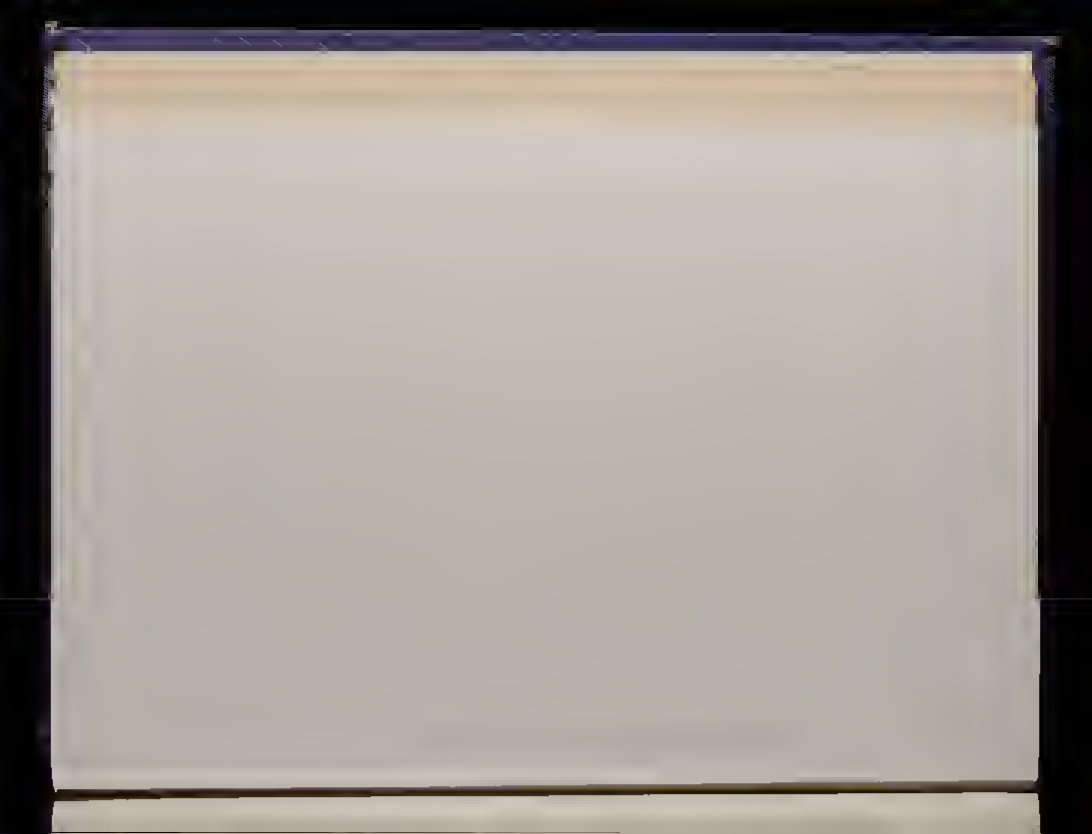
(2) Bacteria introduced in capsule, and then five minutes afterwards a quantity of the boracic powder introduced into the wound No suppuration Slight loss of weight Recovered

(3) Infection as above five minutes later the powder introduced and half an hour later some 20 per cent cresol paste squeezed in No suppuration small local sore Recovered

The last experiment was founded on the directions which it was pro







posed to give for use in the field viz first to powder the wound with the borsal powder, and later to inject the paste (lysol, cresol, &c.)

B.—*Bacillus pyocyaneus and Staphylococcus pyogenes aureus introduced in a capsule*

(1) Control. The bacteria introduced alone into a wound behind the shoulder. Suppuration and secondary abscess in neck. Killed.

(2) Capsule introduced. Borsal powder applied at once. Marked diarrhœa, which, however, only lasted for twenty four hours, and loss of weight. No suppuration or local trouble. Recovered.

(3) Capsule introduced. Borsal powder applied at once and cresol paste in fifteen minutes. No suppuration or loss of weight. Small dry sore at seat of incision. Recovered.

II.—*Experiments with earth rich in tetanus bacilli and Bacillus aerogenes capsulatus*

A.—*Experiments with equal parts of salicylic acid and boric acid (borsal powder)*

(1) Control. Earth (0·2 grm.) rubbed in. Died in thirty six hours with rapid hæmorrhagic œdema. *B. aerogenes capsulatus* recovered from the fluid in connexion with the subcutaneous hæmorrhage. Died.

(2) Earth in capsule (0·2 grm.) and five minutes later borsal powder introduced. Beyond small local dry sore, which formed on the fourth day there were no local ill effects and no loss of weight.

(3) Earth rubbed in (0·2 grm.) five minutes later borsal powder introduced. Wound dried up. No festering. No loss of weight. Recovered.

(4) Earth rubbed in (0·2 grm.), five minutes later borsal powder introduced. Wound dried up. Recovered.

(5) (Experiment on another day.) Earth (0·2 grm.) rubbed in borsal powder five minutes later. Recovered.

(6) Earth (0·2 grm.) in capsule and 0·3 grm. borsal powder in five minutes. Died fourth day. Diffuse hæmorrhagic œdema, and also tetanic symptoms. *B. aerogenes capsulatus* and *B. tetanus* recovered from the wound.

(7) The same method and quantity. Died fourth day. Exactly same result.

(8) Earth (0·2 grm.) was mixed with the borsal powder (0·2 grm.) and the mixture was then introduced into a subcutaneous wound. Recovered.

B.—*Experiments with salicylic acid and boric acids equal parts (paste in water and gum)*

(1) Earth (0·2 grm.) in capsule and borsal paste after fifteen minutes. No loss in weight. Died fourth day. Diffuse œdema and tetanic symptoms.

(2) The same. Recovered.

Series with earth *rubbed into* the wound and borsal paste in gum, glycerine and water.

(1) Control. Earth (0·2 grm.) rubbed in. Died in thirty hours. *B. aerogenes capsulatus* infection. (Chart 4 shows the rapid loss of weight.)

(2) Earth (0·2 grm.) rubbed in, then boracic paste five minutes later. Died in three days. *B. aerogenes capsulatus* infection.

(3) Earth (0·2 grm.) rubbed in, then boracic paste five minutes later. Lost weight at first, then gained. Died of tetanus on the eighth day. *Wound healed.*

(4) Earth (0·2 grm.) rubbed in, boracic paste fifteen minutes later. Died third day. *B. aerogenes capsulatus* infection.

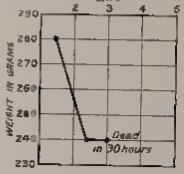


CHART 1.—Control. 0·2 grm. earth rubbed in. Death in thirty hours.

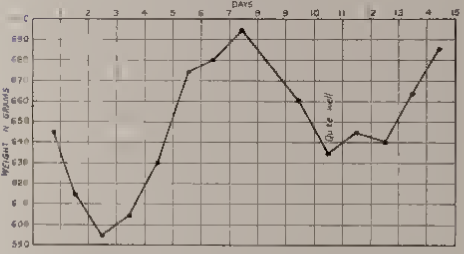


CHART 5.—Guinea-pig inoculated with 0·2 grm. of infected earth in capsule. Boracic powder in five minutes, cresol paste in half an hour.

(5) The same. Died third day. *B. aerogenes capsulatus* infection.

(6) Earth (0·2 grm.) rubbed in, boracic paste thirty minutes later. Died in thirty-six hours. *B. aerogenes capsulatus* infection.

(7) Earth (0·2 grm.) rubbed in fifteen minutes later salicylic and boric paste in proportion of 1 to 3. Died.

Salicylic acid (30 per cent in lanolin) Earth (0·2 grm.) rubbed in fifteen minutes later salicylic paste in lanolin Died on fourth day, acute spreading gangrene.

Salicylic and boric powder (equal parts) followed by cresol paste

(1) Earth (0·25 grm.) rubbed in, borsal powder at once, then cresol paste in fifteen minutes Recovered

(2) Earth (0·2 grm.) rubbed in the borsal powder in five minutes and then cresol paste in fifteen minutes Recovered

(3) Earth (0·2 grm.) in capsule, borsal powder in five minutes, then cresol paste in thirty minutes Recovered (Chart 5 shows the variations in weight)

(4) Earth (0·2 grm.) in capsule, borsal powder in fifteen minutes and cresol paste in thirty minutes Recovered

The above methods with the addition of antitetanus serum

(1) Earth (0·2 grm.) rubbed in borsal powder in fifteen minutes antitetanus serum in four hours Recovered (Chart 6 shows the variations in weight)

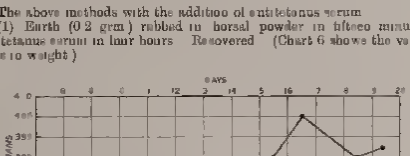


Chart 6.—Guinea-pig inoculated with 0·3 grm. of infected earth rubbed into wound and borsal used &c. Borsal in fifteen minutes antitetanus serum in four hour

(2) Earth (0·3 grm.) rubbed in, borsal powder in thirty minutes antitetanus serum in four hours. Recovered

(3) Earth (0·2 grm.) in capsule borsal powder (0·3 grm.) in fifteen minutes antitetanus serum in twenty hours Died fourth day Acute hæmorrhagic œdema *B. aerogenes capsulatus* and *B. tetanus* both recovered from wound.

(4) Earth (0·2 grm.) in capsule, borsal paste in fifteen minutes, antitetanus serum in fourteen hours Recovered

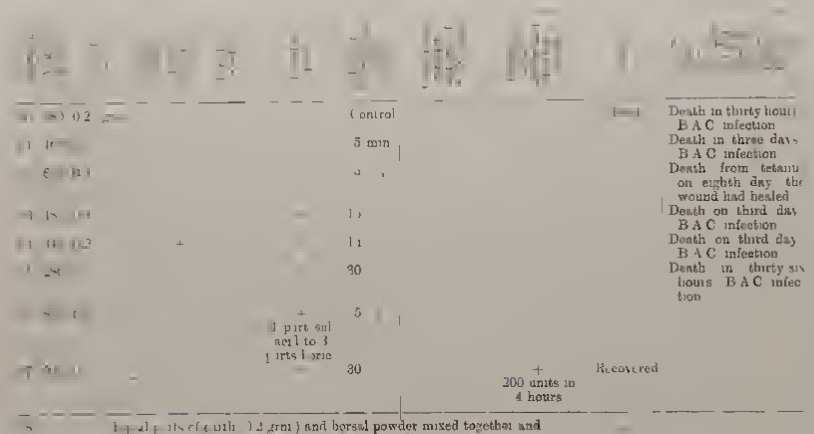
(5) Earth (0·2 grm.) rubbed in borsal paste in thirty minutes antitetanus serum in four hours Recovered

(6) Earth (0·2 grm.) rubbed in borsal powder at once 20 per cent cresol paste in fifteen minutes antitetanus serum after four hours Recovered

The following table shows the results —

															Remarks
															Result	
1	19	0·2	gm						Control						Died	Death after thirty six hours, ædema, hæmorrhagic ædema. B A C present
2	455	0·2							,,						Recovered	
3	335	0·2							,,						,,	
4	420	0·2							,,						,,	
5	845	0·2							,,						Died	Death on fourth day B T and B A C in wound
6	495	0·2							,,							Death on fourth day B T and B A C recovered from wound
7	110	0·2							,,						Recovered	
8	31	0·2							Atropine						,,	
9	210	0·2							,,						+ 30 per cent after 15 min	
10	415	0·2							,,						+ 30 per cent after 15 min	
															+ 30 per cent after 30 min	

11	[illegible]	[illegible]	+ 30 per cent after 30 min		
12	[illegible]	At once	+ 30 per cent after 15 min	+ 200 units after 4 hours	
13	[illegible]	15 min		+ 200 units after 4 hours	
14	[illegible]	30		+ 200 units after 14 hours	
15	[illegible]	[illegible]		+ 200 units after 20 hours	Died	Death on fourth day with diffuse œdema and tetanus; B T and B A C recovered from wound
[illegible]	[illegible]	[illegible]		+ 200 units in 14 hours	Recovered	
[illegible]	[illegible]	[illegible]			Died	Death on fourth day diffuse œdema and tetanus
[illegible]	[illegible]	[illegible]			Recovered	
[illegible]	[illegible]	[illegible]			Died	Death on fourth day B T and B A C recovered


Control
5 min
Death in thirty hours B A C infection
Death in three days B A C infection
Death from tetanus on eighth day the wound had healed
Death on third day B A C infection
Death on third day B A C infection
Death in thirty six hours B A C infection
1 part sulphuric acid to 3 parts borie
+
200 units in 4 hours
Recovered
equal parts of (with 0.2 grm.) and boracic powder mixed together and then introduced into wound

An analysis of these cases shows several interesting points, of which we may mention the following

The total number of cases treated after infection with earth highly charged with *B. tetanus* and *B. aerogenes capsulatus* was 25 and of these 14 recovered

Of these 14 recoveries, 5 were treated with borsal alone 4 were treated with borsal and 30 per cent cresol paste 4 were treated with borsal and antitetanus serum, 1 was treated with borsal and cresol and antitetanus serum

In 15 cases borsal alone was used of these 5 recovered In these cases the borsal was introduced into the wound in the form of powder in 6 cases, of which 4 recovered and in the form of paste with gum tragacanth or lanolin in 9 cases, of which only 1 recovered The explanation of this is not quite clear It may be that the salicylic acid acts better dry, forming a stronger and more active solution when it dissolves in the fluids in the wound but it must also be remembered that a very much smaller quantity is introduced in the form of the paste than in the form of the powder (20 per cent of salicylic acid in the paste as compared with 50 per cent of the acid in the powder) In these experiments as much powder was used as could be introduced into the wound except in three cases where the amount was limited to 0 3 grm (one and a half times the weight of the earth) All those three cases with the limited amount of salicylic acid died, one of them in spite of the use of antitetanus serum at the same time. This raises a very difficult question of the amount of antiseptic necessary relative to the amount of infection, but we have not so far gone into that It also raises the question which arises in all this work viz how much antiseptic can be put into, and left in, a wound in man

The further experiments show that the borsal may be reinforced by subsequent injection of cresol paste for of five cases in which this was done all recovered (one of them being combined also with antitetanus serum) It may also be reinforced by the use of antitetanus serum for of six cases in which this was done only one died, and in that case the serum was not administered till twenty hours after infection

The interesting and important point at the moment with regard to this drug is that in guinea pigs which are very susceptible to this infection a certain number of animals recover completely after minimal doses of bacteria by the introduction of borsal into the wounds soon afterwards fortified by the use of cresol paste or antitetanus serum or probably better, of both

One other point which clearly stands out is that the use of these antiseptics does not make matters worse and favour the spread of the infection on the contrary, even if it does not stop it, it delays it If one looks at the table the control animals died in from thirty to thirty six hours whereas none of the treated animals died earlier than the third day and in one case the animal did not die of tetanus till the eighth day and in the meantime the wound had healed

We have had a patient seen sixty hours after being wounded in the soft parts of the thigh with a bullet and also with a shrapnel bullet The wounds had been treated at the front with methylated spirit and

then sutured it with [illegible] The shrapnel wound was foul smelling and highly suppurating, the skin around was red and the parts brawny. This wound was freely opened, dried and powdered thoroughly with boracic and subsequently filled up with cresol paste. When dressed next day there was no odour and very little discharge, and the brawny condition had markedly subsided. A part of the bullet track however, which had not been treated was brawny and septic and then more powder and paste were introduced. The wound healed rapidly. *B. tetanus* and *B. aerogenes capsulatus* were found in it when first seen.

Other Antiseptics

Various other antiseptics have been tested as to diffusion in agar, but we have not yet had time to study them more fully.

Puraform 5 per cent in lanolin and wax base (fig. 33). This gives a good clear area 43 mm. in diameter. Immediately outside this area the colonies are large.

Bichloride of mercury, 0·2 per cent in lanolin and wax base. Here there is a clear area about 36 mm. in diameter. The colonies are also large right up to the edge of the clear area (see fig. 34).

Oil of turpentine, 20 per cent in lanolin and wax base. No inhibition, free growth of colonies all over the plate (fig. 35).

Oil of eucalyptus 20 per cent in lanolin and wax base. No inhibition. Growth all over (fig. 36).

Various essential oils

Oil of origanum 20 per cent in lanolin and wax base. Centre clear, but in the immediate neighbourhood there are isolated colonies (see fig. 37). Diameter of complete inhibition area 25 mm.

Oil of cinnamon (bark). Good inhibition. Diameter of area of clear inhibition 46 mm. (see fig. 38).

Cinnamic aldehyde. Diameter of inhibition, 46 mm.

Oil of cloves. Diameter of inhibition 30 mm.

Friars' balsam (piece of filter paper soaked with the balsam and placed in paraffin cell). No inhibition, free growth.

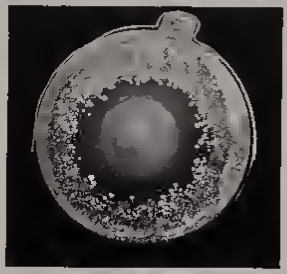
Balsam of Peru (filter paper as above). Good clear circle. Diameter of inhibition area 37 mm. (see fig. 39).

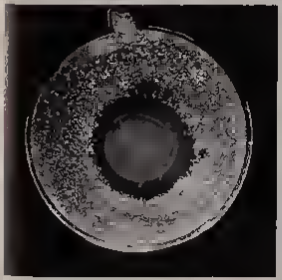
Dr. Mencière's embalming solution (see *Lancet*). No inhibition, free growth.

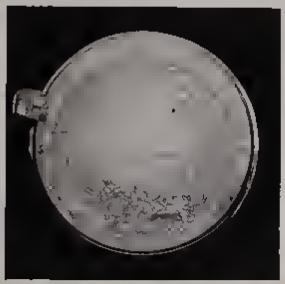
Colloidal mercury, selenium, copper and silver. No inhibition with any of them, free growth.

We are at present engaged in investigating preparations of Peroxide of Hydrogen at Sir William Ramsay's request, which seem most promising and will be reported on in due course.

Although this is only a preliminary report the results so far as we have gone are most encouraging and already it seems worth while to apply the method to wounds in war. That certain substances would diffuse through blood tissues and agar was of course known, but in what way this diffusion takes place and how anti-







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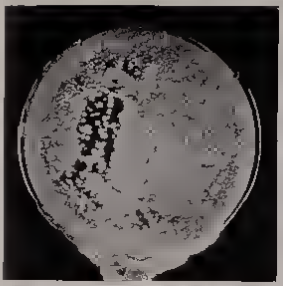

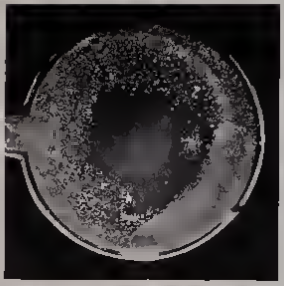

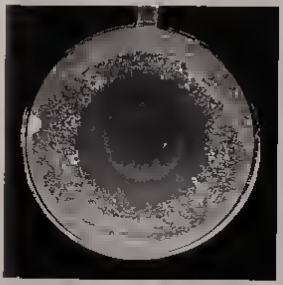

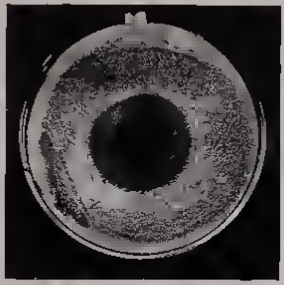

septics act in relation to the growth of bacteria at a distance had not been worked out We find that quite a number of substances can diffuse through a considerable thickness of material, and influence the growth of the bacteria which they may meet with in their course The radius within which they act seems to depend to a considerable extent on the concentration and the quantity of the antiseptic at the site from which it radiates, on the base with which it is combined, and on the extent of surface to which it is applied Assuming that radiation takes place in all directions from the centre naturally the further away from that centre, the more dilute will be the antiseptic substance Hence the action is most marked at the point nearest the centre For example, with a disc of agar $\frac{1}{4}$ in thick placed over an antiseptic paste the earliest and most potent effect on the growth of bacteria on the surface of that disc is seen at the very centre As we pass away from that point, the action becomes weaker and less certain till a point is reached where the antiseptic is unable to interfere with growth at all Before that point is reached, there are areas in which varying effects are observed according to the time that the antiseptic has taken to diffuse in sufficient quantity to produce an effect on growth Antiseptics vary considerably in their rate of diffusion and naturally also in the quantity which passes through a certain distance in a given time The clear area which is seen in a number of these preparations indicates inhibition of growth, and the amount necessary to produce that effect must have passed through at the latest in two hours Hence we have a means of estimating the rapidity of diffusion and the power of inhibition of various antiseptics, but that area does not indicate the limit of ultimate diffusion, but only the amount, sufficient to inhibit growth which passes through in a given time For example if a plate is made with picric acid the whole plate will soon become yellow showing that the acid has diffused over a large area, but there will only be a small, clear circle, quite at the centre, showing that only at that point had the picric acid come through in sufficient quantity to prevent the growth of the bacteria on the surface before they had time to form colonies Even after three hours some antiseptics will continue to come through till a sufficient amount is present to arrest the growth of colonies which have already formed, but in the case of most of the active antiseptics the amount necessary to produce inhibition has already come through in an hour or two, and there is only slight extension of the area of restricted growth

afterwards. Again, some antiseptics not only inhibit the growth, but also kill the bacteria, while others may inhibit growth over a large area, but do not kill the bacteria even after twenty-four hours. In estimating the value of an antiseptic for our purpose we have to consider not only its power of inhibiting growth, but also its power of killing bacteria, and there is a great difference between inhibition and destruction. Some substances may inhibit over a large area, but do not kill at all, e.g. borax, while others, e.g., salicylic acid, kill quite readily.

Of the substances which we have tested boric and salicylic acids, cresol, and carbolic acid seem to be the most useful for our purpose. It may, however, quite well happen that others which we have not yet studied would do better. In the meantime, however, the substances which we have mentioned seem well worth testing in man on the principle that we have been investigating. Cresol and carbolic acid have very considerable activity at a distance both as inhibitory and as destructive agents, and when combined in a wax and lanolin base, go on diffusing for a very considerable time. The result is that they prevent the growth of bacteria over a considerable area, and are able also to destroy the ordinary pyogenic non-spore bearing bacteria over the greater part of that area. The mixture of boric and salicylic acids is more potent in both directions, and, apparently, as evidenced by experiments on guinea-pigs, can prevent the action of spore-bearing organisms also. In some ways, however, this mixture of boric and salicylic acids is not so suitable as the others, especially in that it is not stored up in the same way. But the combination of borsal powder with cresol or phenol pastes seems very efficacious in animals. We are, therefore, of opinion that the time has come when this combination should be given a thorough trial in man.

In our experimental work boric and salicylic acid have not acted so well in the form of pastes as in powder. In a paste with lanolin and wax it does not diffuse at all well, and in the experiments on animals the paste with gum tragacanth, which diffuses very well in agar, did not act nearly so well as the powder. But as we said at the beginning a powder is not so satisfactory as a paste in wounds in war, because it would be very difficult to apply it to the whole interior of the wound, and it would also be very apt to be carried away by the blood and be lost. We therefore propose that borsal (salicylic acid and boric acid in equal parts) should be used as a powder and thickly dusted over the wounds as far as possible, and that its action should be reinforced by the

injection of cresol paste (20 per cent in lanolin and wax base) into the interior of the wound in various directions. As a matter of fact the soiling of wounds with earth is not likely to extend to any great depth, and the boracic powdered over a wound especially if it is well open and the bleeding has stopped, will probably overtake the severe earth infection, while the septic organisms carried on further will be dealt with by the cresol. At any rate the growth of organisms will be inhibited over a large area till the patient reaches the dressing station where the wound can be opened up and more thoroughly attended to. It would of course, be much better if we could attain our object with a single antiseptic and we propose to make further experiments in the hope of attaining a satisfactory paste with salicylic acid, but in the meantime the combination which we suggest promises to be of considerable value in these cases.

It is proposed to issue this combination to the Navy[1] in the form of pepper pots containing about 1 oz. of boracic and of paint tubes containing $\frac{1}{2}$ oz. of 20 per cent cresol paste the tubes being provided with nozzles about 2 in. in length which are screwed on the ends of the paint tubes, so that they can be introduced into the depths of the wound in various directions. This tube should only be used on one patient, and then thrown away. In the ships a sufficient quantity would be issued to deal with the probable number of wounded, in the case of Naval contingents acting on shore each man would have a pepper pot and a tube in his field dressing. In the case of a wound at the Front the first thing is of course, to stay the bleeding as much as possible, and then to powder the whole surface thickly. The cresol tube is then introduced into the wound and small quantities of the contents are squeezed into it in various directions, endeavouring as far as possible to leave small portions of the paste scattered over the whole area of the wound, not more than 1 in. apart. Some of the paste should also be smeared over the skin around the wound, and after a final dusting with the boracic powder the emergency dressing is applied. This can all be done quite quickly, and then the patient can wait till such time as the wound can be more thoroughly attended to.

When the patient arrives at the advanced dressing station the treatment depends on circumstances.

(1) If a large number of wounded have to be attended to,

[1] These preparations are now issued by all the Royal Naval Hospitals together with a memorandum of instructions.

patients who have been treated in the above manner can wait, unless a good many hours have elapsed since the injury. In that case the orderlies should inject a little more paste into the wounds and powder them and apply a fresh antiseptic dressing while the patient waits his turn.

(2) If it is a large or complicated wound e.g., a compound fracture it will be well in the first instance to clean and disinfect the skin, preferably with 1 in 20 carbolic lotion, then wash out the wound with peroxide of hydrogen and 1 in 20 carbolic lotion remove pieces of clothing or accessible pieces of shell clip away any badly soiled tags of tissue and arrest the bleeding. The wound being dried and held open it can now be powdered with boracic and some cresol paste left in various parts of the wound. If it is widely open it may be well to put a few interrupted sutures in to bring the edges somewhat together and prevent the escape of the antiseptic, and finally apply antiseptic dressings.

(3) If it is not a large wound if the clot seems solid and if it has been well powdered and plenty of paste introduced into it in the first instance, it is quite possible that sepsis may not occur and if that seems likely all that need be done would be to squeeze a little fresh paste and dust some boracic powder over the surface and the skin around and apply a fresh antiseptic dressing.

These wounds will probably not require further dressing till they arrive at the base hospital.

Subsequent Treatment at the Base.—Should the wound be free from sepsis or inflammation on arrival at the base hospital it should not be opened up or syringed or otherwise interfered with. Some fresh paste diluted if necessary, may be applied over the surface and the skin and a fresh antiseptic dressing put on.

If on the other hand, there are signs of sepsis the wound must be opened up and drained, and otherwise treated according to the experience of the surgeon.

REPORT ON THE CASUALTIES IN THE ACTION BETWEEN THE "PEGASUS" AND THE KÖNIGSBERG

By Staff Surgeon A. C. Hewitt, R.N.
Late of the Empress

As a result of this action, which took place at Zanzibar on the morning of September 20, 1914, 24 men of H.M.S. "Pegasus" and one native servant were killed, and 8 officers and 69 men wounded. Of this 3 officers and 26 men admitted to the European hospital, 2 officers and 1 man died the same day. Subsequently 5 more men died of their wounds.

After the action all the wounded were conveyed ashore to the European Hospital, situated on the sea front, and from there 38 were sent to the Native Hospital at Mnazi Mmoja half a mile away and 4 to University Mission Hospital at Mkunazini, about one mile from the European Hospital. The remainder were treated in camp at Zwani.

The most remarkable feature of the wounds was the large number of minute superficial wounds and burns looking like the pitting of black powder, also the small penetrating power of the fragments in open spaces like the upper deck. The danger zone as far as life was concerned seems confined to a small area round the bursting space, and although the initial velocity of the fragments appears to be very great, this seems to rapidly diminish, perhaps owing to the irregularity of their shape.

A large number of fragments were removed from the wounds at a depth of from 2 in. to 4 in., some embedded in bone and some in the soft tissues. In the two penetrating wounds of the skull the entrance wounds were of identical shape and size to the shell fragments found, but in neither case did the missile penetrate more than 4 in. A bullet would certainly have penetrated much further.

A leading seaman had his right arm so shattered that a primary amputation was necessary, but a fragment of the same shell hit the brass buckle of his belt, breaking it, but not even bruising the abdomen.

Small fragments were also the cause of the loss of four eyes, and I am of opinion that a pair of motor goggles would have saved all these.

A case of aneurysmal varix occurred in the right common

carotid and jugular vessels can all by a minute particle of shell which probably could have been stopped by a linen collar

In my opinion a coat of light chain armour or even leather with a pair of goggles made from toughened motor screen glass would be invaluable to captains of destroyers navigators, and others in exposed positions who are likely to encounter ships armed with similar guns There were only a few cases of arterial hæmorrhage and these were controlled by tourniquets

Injuries to Bones—Most of the fractures were comminuted, and the extent of the comminution appeared to be proportionate to the nearness of the explosion A leading stoker had his right shoulder so shattered that the particles of humerus clavicle, and scapula felt like sand On the other hand a leading signalman had his left humerus broken by a piece of shell which fell off when it had penetrated to the bone

Shock was present in nearly all the wounded, and I found the administration of morphia hypodermically in ¼ gr doses had a very beneficial effect Most of the casualties occurred on the upper deck, and the scene that this presented can scarcely be imagined Yet there was very little noise on board from the wounded and one was impressed by the death like silence between the periods of appalling din created by the salvoes Although the ship was in harbour and only a short distance from the shore no one attempted to jump overboard, and there was no panic The morale of the men was magnificent

The fumes of the high explosive powder used seem to have a sickly stupefying effect and perhaps caused a feeling of dizziness, but this may have been due to concussion I, personally, had been breathing more deeply than normal in assisting a wounded man up a ladder from the after torpedo flat where these fumes were particularly dense, and experienced a feeling of nausea and dizziness For several days afterwards on deep breathing, one seemed to exhale the same fumes Others were affected in a similar manner

Practically every compartment occupied had some casualties except the engine room and stokeholds which seem to have been protected by their coal bunkers from the non-piercing shell The after flat, although unoccupied, was also badly damaged, and also the Captain's cabin

In unprotected ships instead of having collecting stations with stretcher parties I would rely more on the wide distribution of first aid dressings, including a bottle of tincture of iodine and a brush and a thorough instruction of the ship's company in first aid

Stretcher parties were useless on this occasion and instead of these a thoroughly trained man might be allotted to each gun whom he would run less risk of injury than in the objectless carrying of the wounded and be actually on the spot to render assistance if the wound so treated were slight the man might be able to continue at his duty.

It may be argued that the presence of a wounded man would deleteriously affect the remainder of the gun's crew but this is not borne out by experience At the end of an engagement, there is more probability of some of the nursing staff surviving than if the whole number were collected in one or two stations

In many cases the outward appearance of the wounds suggested trivial injury, and it was only afterwards, and at times under an anæsthetic, that the full extent of the damage was disclosed All that is necessary and indeed possible at the time is the arrest of hæmorrhage, which is rare and the quick application of iodine and first aid dressings This does not need elaborate skill

I would also be inclined to add to each bag of dressings a bottle of morphia in solution of such strength that a syringeful contains ¼ gr Waterproof or damp-proof bags might be made to contain the dressings As the electric light is almost certain to fail, especially in compartments that have been hit and as these spaces may contain a number of wounded, I would suggest that electric torches be provided for first aid parties as giving a good movable light, free from the risk of fire

ARRANGEMENTS FOR THE TREATMENT OF WOUNDED IN ACTION IN THE "PEGASUS"

Collecting Stations.—Two collecting stations were selected (*a*) The stokers' mess deck forward on the lower deck below the sick bay (*b*) the torpedo flat aft on the lower deck, below and forward of the ward room These compartments were selected as being the only feasible places to which the wounded could be transported and because when completed with coal and stores the deck of these spaces was about 4 to 6 m below the water line

One station was in charge of the sick berth steward, who was assisted by one cook from the galley, the foremost stretcher party and forecastle party One station was in charge of the staff surgeon, who was assisted by one cook, and the after stretcher parties and the poop bearer party

The two collecting stations were supplied with first and

instruments, medical comforts (bovril, &c.), feeding cups, dressings, lotions, hot and cold water, also two wide neck bottles of morphia solution (a syringeful containing ½ gr.). On action being sounded the cooks brought with them to their respective stations a fanny of hot water and two others a similar amount of cold water.

All the first aid parties fell in at these collecting stations.

The stores for the foremost station were kept ready in the sick berth, in portable sizes and those for the after station were kept in the dispensary, opening off the torpedo flat. Additional dressings were also provided in the ward-room and in the sick berth.

Each gun was supplied with a canvas bag containing one india-rubber tourniquet and six improvised calico tourniquets (with a cork sewn crosswise in them), a number of bandages, and a packet of sterilized dressings (inside being a roll of gauze and lint, surrounded by a roll of cotton wool, the whole rolled in calico bandage), a pair of scissors, and a pad of tow. These bags were fastened inside the shields of the guns, and inspected frequently. A similar bag of dressings was also supplied to the forebridge and to the after control, and these two positions were also supplied with a hypodermic syringe and morphia solution. The yeoman of signals and the officer in charge of the after control were instructed in their use. The engine-room, in addition to the bag of dressings, was supplied with jars of carron oil and some picric acid dressings. These were kept in the engineer's workshop. Special lights were fitted in the two collecting stations.

Owing to the difficulty of passing the wounded down the ladder to the foremost collecting station (a steel support for the hand pump came directly opposite the hatch), only patients who were able to walk were sent below and those unable to walk were placed between parallel hammocks on the upper deck on the starboard side forward of the sick-bay. Those brought to the after collecting station were passed down through the torpedo hatch in a horizontal position and placed between hammocks arranged similar to above.

Stretchers.—The stretchers provided were of plain canvas, with two bamboo poles kept stretched apart by collapsible bar at each end, standing on 4 in. iron supports. These were found so unsuitable that the following alterations were made by me:—

(1) A permeni pad and straps for the thighs were attached to straps to go over the shoulder (2) strap for the legs above the ankles.

From the outbreak of war three stretchers were kept in position on the upper deck one under the break of the forecastle, one amidships at B pump, and one just under the poop On the forecastle and poop hammocks were kept fitted in a manner similar to the stretchers each provided with a lowering rope at each end On the forebridge, a similar hammock was kept, fitted with a long rope which passed through a block attached to the foremast, and by this a wounded man could be lowered in an upright position to the forecastle A steadying rope was fitted to the lower end For the stokehold and engine room, a canvas seat was made for conveying the wounded from below This was improvised with two armholes A rope attached to the middle, behind and above the head and two side ropes A steadying rope was attached to the middle of the front of the seat This arrangement worked fairly well in practice

The stretcher and hammock parties consisted of seven non combatants of the ship's company distributed as follows Two on forecastle, two on poop one in charge of each of the three stretchers The stretchers had in addition two coloured men each

Transport and Treatment of Wounded

Directly after the action the s s "Banffshire, which was lying two cables ahead of us had lowered her boats, and as soon as the firing ceased, very promptly sent them to our assistance The wounded were placed in hammocks (which were lashed and stowed in the nettings on the upper deck) and sent ashore in the 'Banffshire's boats All the wounded had first-aid dressings applied and nearly all the serious cases had had a hypodermic injection of ½ gr of morphia All were landed within an hour The landing was difficult owing to the rapidly ebbing tide, and boats being required as soon as the wounded were landed to return and stand by the ship as it looked as if it would be necessary to abandon her From the European Hospital the less serious cases were conveyed by motor-cars, rickshaws, &c, lent by the residents, to the other two outlying hospitals Stretchers were found useless on board, but the bags of dressings at each gun were of the greatest service, and the men who had been trained in first aid greatly assisted each other The landing was facilitated by the loan of stretchers from Major Skelton, R A M C, who had had a large number made in view of the expeditionary force against German East Africa which was expected from India It was impossible to examine all the

[illegible] as to the [illegible] but from general observation at the [illegible] the majority [illegible] the result of general mutilation and head injuries One man had his head removed except a small portion of the occipital bone another was hit in the chest by a piece of shell which passed through his heart On the stokers' mess deck the men were in their hammocks when a shell exploded killing four and fatally wounding two others This accounts for the large number of stokers killed, notwithstanding the fact that the engine room and stokehold were undamaged

	Killed	Wounded
Officers and seamen	9	40
RA's and stokers	9	14
Marines	3	3
Daymen &c	4	12

The hospital accommodation on shore was excellent, and had been arranged with commendable forethought by Dr MacDonald PMO Zanzibar

Conveyance of Men in Hospital Ship "Gascon"

Orders were received from the Commander in Chief to convert s s Gascon into a hospital ship to convey those of the wounded fit to travel to Simonstown The medical staff on board consisted of Dr Stitt the ship's surgeon and an ex-RAMC stretcher bearer I applied for another surgeon to assist on the voyage and I eventually obtained the valuable assistance of Dr Curment Assistant Medical Officer of Health at Zanzibar also two native hospital boys and a Cingalese dispenser A number of stewards on board the "Gascon" also volunteered to attend on the wounded and act as stretcher bearers to and from the dressing station A number of first- and second class cabins were selected, and a "skid" built for hoisting the wounded Out of the total wounded, thirty two were able to be transferred five were unfit to move, and the remainder were able to resume duty at an early date Of the five unfit to move two subsequently died As the depth of water at the hospital steps did not admit of lighters remaining alongside except at high water the less serious cases were embarked on the evening of September 29 and the remainder on the following morning The stretchers were put on the lighter decks and towed alongside the Gascon The stretcher was then placed on the skid and accompanied by a man at each end hoisted on board by a derrick The voyage south was uneventful and all

[illegible] progressed rapidly in health [illegible] on October 9 but, owing to the [illegible] unable to land the wounded until the morning [illegible] They were then all transferred to the R N Hospital

NOTES ON THE CASES

[illegible] A compound comminuted fracture of left ankle opening into [illegible] compound fracture of leg about the lower third (c) a com[illegible] comminuted fracture of left thigh near the great trochanter, with [illegible] lacerated wound of muscles of left buttock His thigh was dis[illegible] cultured at hip joint and a triangular radiating fracture was found in the acetabulum He died shortly after the operation This officer was running along the port side towards the forecastle when he was hit in the ankle and fell under No 8 gun Two men went to his assistance, but another shell exploded close at hand killing one and wounding the other, and apparently causing the injury to the officer's hip which proved fatal I personally attended to his injuries on board, and also administered morphia hypodermically

(2) Compound comminuted fracture of both legs, that of left just below knee joint, and that of right passing through knee joint Also a lacerated wound about 1 in in diameter penetrating the right side of chest at angle of scapula causing pneumothorax Amputation of both thighs above the knee joints was performed, but he died shortly after the operation He was wounded soon after the engagement began tourniquets were applied to both legs, and a pad of wool and gauze placed in thoracic wound He was on the port side of the upper deck just outside the ward room galley

(3) (a) Laceration of frontal lobe of brain (b) both eyeballs and upper part of face completely destroyed He died at the European Hospital shortly after being brought ashore

(4) (a) Penetrating shell wound of left parietal region (b) lacerated penetrating wound of abdomen He died the same day

(5) (a) Compound fracture and laceration of frontal lobe of brain left side (b) destruction of left orbit and part of face He died the same day

(6) (a) Penetrating wound of skull (b) lacerated wounds of face (c) compound fracture of right arm and right thigh He died the same day

(7) A compound fracture of the neck of right humerus A large fragment of shell had penetrated his right axilla and tracked downwards through the lung It had also probably penetrated the diaphragm as the patient complained of severe abdominal pain He died the same day

(8) (a) Deep wound of right side of neck (b) flesh wounds of right arm and shoulder (c) wounds of back penetrating abdominal cavity He died from peritonitis at 3 45 a m on September 21

(9) (a) Punctured wound of skull $\frac{1}{2}$ in in diameter situated $2\frac{1}{2}$ in above inner half of left eyebrow lemon of lacerated brain tissue (b) perforating wound through muscles of left buttock (c) small multiple superficial wounds back of legs and left foot Signs of compression

appeared on [illegible] He was [illegible] on September 29, and fragments of [illegible] owing to [illegible] Pulsation of brain [illegible] present [illegible] and passed in the involuntarily [illegible] Cheyne Stokes breathing appeared [illegible] He eventually died on September 27 A piece of shell weighing just over an ounce was found in his left ventricle After his injuries this patient applied first aid dressings to himself and offered to assist the other wounded He stated that he had received a few scratches only I sent him ashore in one of the first boats and when I examined him later I found the foregoing injuries

(10) Wound passing through base of nose, left orbit and left cheek emerging below left ear causing (*a*) compound fracture of base of nasal bones and cribriform plate of ethmoid (*b*) complete destruction of left eyeball (*c*) motor facial paralysis left side from injury to branches of nerve (*d*) superficial wound left shoulder in direct line with above and probably caused by same missile Direction of missile from nose to ear suggested by splinters of wood in eyelids of damaged left eye and overturn of tissues at wound below ear a portion of parotid gland was found at outer angle of orbit At operation the left eye was excised Direct continuity between nasal, eye and parotid wound was found and all the track contained fragments of nasal orbital malar zygoma superior maxilla, and a part of the ramus of the lower jaw All pieces were carefully removed and an attempt made to cut off nasal cavity from wound of orbit and cheek by attaching mucosa of nose to edges of wound Case has progressed very favourably

(11) (*a*) Deep irregular shell wound back of base of neck, right side through trapezius fibres, passing forward towards right clavicle which was fractured (*b*) pressure on brachial plexus (*c*) irregular 2 in wound just below angle of right scapula and to outer side, through the fibres of latissimus dorsi The wound in neck was found to communicate with fractured clavicle (compound) at about the middle of the bone Sanguineous and purulent discharge from both wounds The tenderness of the neck and œdema of the shoulder made the fixation of the limb for the fractured clavicle difficult The previous pressure and bruising of the brachial plexus has partially passed off The two wounds have been found to communicate so that a foreign body is not likely to be retained No fracture of scapula can be detected nor do any ribs appear to have been damaged The position of the wounds would suggest that the patient was in a slightly stooping attitude with the head down and that the entrance wound was at the angle of the scapula the missile passing under the scapula and out at the wound in the neck The shock of the blow would probably cause the patient to fall down, and so cause the fracture of the clavicle The result has been paralysis of the serratus magnus from injury to the nerve of Bell

(12) (*a*) Severe laceration and destruction of tissues from fingers to middle of right arm, (*b*) lacerations and bruising of the lower part of [illegible] (*c*) small multiple splinter wound of back shoulders left [illegible] (*d*) deafness and purulent discharge from right ear [illegible] from ruptured tympanum Right arm was amputated in [illegible] of humerus and several small splinters removed from his back [illegible] The amputation wound healed well and patient is now [illegible]

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the common carotid and internal
jugular vein The tumour
creased appreciably in size and the
foreign body is retained There has been no noticeable change in his
condition

(15) (*a*) Penetrating wound right upper arm outer aspect, entrance wound at junction of upper and middle thirds through deltoid and biceps muscles downwards and inwards, grazing the humerus, exit wound about the middle of humerus in front of vessels and nerves which were uninjured (*b*) perforation of both tympani, (*c*) comminution of outer part of humerus at entrance wound Wound healed well, after scraping of bone but permanent partial loss of hearing in both ears

(16) (*a*) Penetrating wound left forearm entrance an inch below head of radius on mid flexor aspect downwards, backwards and inwards to exit at junction of middle and lower thirds compound comminuted fracture of ulna between the two wounds vessels and nerves apparently uninjured (*b*) superficial wound of left shoulder (*c*) punctured wound of right forearm ½ in deep on outer side of mid-flexor aspect (*d*) nail of right thumb torn off The wounds healed well, but there is partial loss of supination of left forearm

(17) Compound comminuted fracture of left forearm shattering 3 in of the shaft of the ulna from ½ in below olecranon and the head and upper fifth of the shaft of radius An attempt was made to save the limb but amputation was subsequently necessary, and was performed at lower third upper arm

(18) (*a*) Wound of right parietal region 1 in from mid line, slightly postero-lateral to Rolandic fissure, penetrating skull with hernia of brain tissues wound ½ in in diameter roughly circular small spicules of bone were removed from the protruding brain tissue (*b*) deep wound penetrating left flank 2 in above crest of ilium and 3 in from the spine admitting one finger margin of kidney could be felt but was uninjured the flank wound caused no abdominal symptoms except a small clot of blood mixed mucous passed *per rectum* on the day following the injury
(*c*) flesh wound of left upper arm on middle posterior aspect from which small pieces of shell were removed, and multiple superficial

[illegible]

[illegible] this [illegible]

(1) [illegible] below [illegible] inch w[illegible] penetr[illegible] of splint [illegible]

(d) [illegible] and radius [illegible] ulna of right arm [illegible] upper third (*b*) superficial wound [illegible] buttock (*c*) [illegible] wounds of back All wounds healed well

(3a) (*a*) Contused wound just behind the internal malleolus of left [illegible] tendons injured but posterior tibial artery divided vessel tied (*b*) perforating wound of right thigh about the middle of posterior [illegible] with large piece of shell embedded in flexor muscles 4 in higher [illegible] slightly inwards (*c*) small punctur[illegible] wound behind vessels and [illegible] right arm hæmorrhage into tissues and bruising as far as elbow [illegible] tenderness pain in hand and fingers (*d*) small multiple wounds and [illegible] of right leg and thigh Case has progressed favourably

(2a) (*a*) Contused wound of forehead above inner half of right supra [illegible] ridge (*b*) penetrating wound of inner lower segment of right cornea with prolapse of iris hæmorrhage into anterior chamber (*c*) three puncture wounds back of right forearm just below head of elbow two [illegible] extensor muscles and other internal to ulna (*d*) contusion of hands [illegible] finger of left and thumb of right hand) fracture of first right [illegible] metacarpal bone (*e*) contusions of face with suspected fracture of frontal [illegible] with supra-orbital tenderness Intraocular tension diminished It [illegible] found necessary later on to excise right eye Case has progressed favourably

(3) (*a*) Lacerated penetrating wound right scapular region below [illegible] with spine direction downwards and inwards no fracture or foreign body found but patient has complained of pain on deep inspiration there was no fluid in pleura or sign of lung injury (*b*) superficial puncture wound of front of both thighs Later, a pint and a half of pleural fluid was aspirated from right side of chest and X-ray examination showed fracture of ninth rib and foreign body lodged at the side of body of the second lumbar vertebra The foreign body is still retained and the patient has resumed duty

(24) (*a*) Lacerated perforating wounds of left forearm causing compound fracture of both bones Missile entered on inner side about 2 in above the lower end of ulna and passed transversely across the forearm emerging on the dorsum shattering the inner side of the radius and fracturing the outer segment which is held together by periosteum the ulna was comminuted for 4 in of its length (*b*) superficial wound of left side of scrotum The case has done extremely well and patient will have the use of his hand but there is permanent loss of extension of fingers

(25) (*a*) Penetrating wound of right eye at outer margin of cornea with prolapse of iris and escape of aqueous fluid, foreign body retained in back of eye (*b*) superficial wound about 1 in long on outer side right thigh junction of middle and lower thirds The wound in eye healed up after almost complete iridectomy but there was a good deal of

[illegible] necessi[illegible]

(26) [illegible] inner seg[illegible] which b[illegible] small ante[illegible] were rem[illegible] but there has [illegible] been consult[illegible] penetrat[illegible] through extensor muscles [illegible] slightly upwards. Difficulty of [illegible] under tendon of biceps. An abscess form[illegible] to jugal ship ' Gascon and foreign [illegible] removed in hospital Simonstown [illegible] elbow joint on brachialis anticus muscle [illegible]

(27) (a) Lacerated wound [illegible] with considerable bruising and [illegible] nasal ring extending upwards towards [illegible] (b) small punctured wound below [illegible] from which a small piece of [illegible] jugal ship ' Gascon (c) superficial [illegible] and [illegible] An abscess formed over right [illegible] ing and was opened. A track was found leading [illegible] and also [illegible] in the direction of the wound [illegible]. This would suggest that same missile was the cause of [illegible]. The want of continuity of the track was probably [illegible] of the tissues some time having elapsed since the injury [illegible] to England from Simonstown for duty.

(28) Penetrating abdominal wound [illegible] direction downwards and backwards. Piece of [illegible] was protruding from the wound. The patient died on the morning [illegible] September 21, from peritonitis. It was found at the post-mortem that the missile had passed through descending colon two loops [illegible] small intestine, had torn branches of inferior mesenteric vessels and lodged [illegible] pelvis on opposite side.

(29) Lacerated penetrating wound [illegible] left scapula direction vertically downwards. The bottom of the track was opened and the tenth and eleventh ribs found fractured with a piece of serge attached to the fractured ribs. The missile had entered the chest. Pleural fluid with very little blood and only a trace of pus was drained off but the patient died on September 27. A post mortem examination disclosed the pleura and lung uninjured a perforation of the diaphragm with a piece of serge at the side of the opening, a rupture of the posterior part of the spleen behind the peritoneum, a track downwards behind the left kidney and a piece of projectile lodged in the psoas muscle.

(30) (a) Penetrating wound of chest on right side in third intercostal space slightly anterior to the nipple line; this resulted in pneumothorax later a foreign body was removed from the same side embedded below the latissimus dorsi muscle at the same level as entrance wound. (b) contused wound of right eye with effusion of blood into both chambers but no external wound of eyeball upper eyelid lacerated in centre fourth

and two [illegible] bodies [illegible] front of chest (three) [illegible] right clavicle. From all these foreign bodies [illegible] beneath the skin. The pneu[illegible] wound [illegible] removed from the dangerous [illegible] before [illegible] 30. The haem[illegible]rhage in the right eye [illegible] defective and intra ocular tension [illegible]. There is [illegible] light entering it upper segment only. [illegible] photograph shows [illegible] foreign bodies in right orbit outside eyeball [illegible] small foreign body about 4 in deep [illegible] to the right of the [illegible]. The [illegible] was landed from hospital ship Gascon on October 11 and subsequently invalided to England.

(31) (a) Contused wound [illegible] left leg, left [illegible] and left thigh. (b) [illegible] of right eye and burning of left eye [illegible] destruction of left [illegible] of frontal bone [illegible] protruding. The [illegible] on the [illegible].

[illegible]

[illegible] JOHN R MUIR [illegible]

[illegible] are the detail[illegible] and the [illegible] Tuesday [illegible]

General Arrangements

There [illegible] Forward Medical Distributing Station an After Distributing Station two ratings trained in first aid with a Neil Robertson stretcher in each turret and one of the 6-in gun's crew trained in first aid to each gun

A Neil Robertson stretcher was placed at each end of the 6-in batteries on both sides Each turret was supplied with a first aid bag and also a hypodermic syringe with a solution of morphia which when the syringe was filled gave a dose of $\frac{1}{4}$ gr One of the ratings trained in first aid was taught how to give a hypodermic injection but was only allowed to administer it on the orders of the officer of the turret The ratings trained in first aid at the 6-in guns were also supplied with a first aid bag but no hypodermic syringes

Forward Distributing Station

This station is situated almost immediately below B turret The ship's armour at the side is 6-in thick and there is a 3-in rising round the station itself with an armoured door Except for its unpleasant proximity to the 14-in magazine it is probably the safest place in the ship It is properly fitted up with hot and cold water light medical store room and cupboards containing tablets

Prior to the action the whole station had been sterilized and painted out and the corticene on the floor covered with shellac varnish The station would be better with the addition of a mess but to supply this means cutting through armour

Personnel Attached The staff surgeon, 1 surgeon, the fleet paymaster, the chaplain, 1 sick berth steward 2 sick berth attendants 1 chief and 3rd writer, 1 cook and 1 officer's steward

After Distributing Station

This is on the main deck, almost under X turret and is simply an open athwart ship space It is protected by the 6-in armour of the ship's side and is surrounded by officers' cabins

[illegible] shell [illegible] upper [illegible]. This shell was very destructive [illegible] pounds. It [illegible] up the trap hatch in the roof of the distributing [illegible] which communicated with the gun control tower killed [illegible] who was standing on the hatch, seriously wounded another [illegible] severely scorched the face of a third, all of whom were in the [illegible] control tower. In its explosion in the distributing office [illegible] killed six men and wounded five men. To the port 6 in. gun [illegible] the same shell killed a boy and injured a midshipman and [illegible] boys.

An urgent telephone message was received from the gun control tower and an ambulance party was sent off in charge of a surgeon [illegible] what could be done. This party had considerable difficulties as the lights had all gone out, the alleyway was wrecked and the [illegible] past the distributing office, which was the only possible [illegible] was [illegible] to bits and threatened by fire from the middle [illegible] office, which was immediately below the distributing office. Thanks to the heroism and bravery displayed by a sick berth attendant [illegible] two boys all the cases mentioned except one who [illegible] after the action was over, were brought down to the [illegible] distributing station.

When they arrived seven were dead or expired as they were [illegible] on the [illegible]. The dead were laid on one side as decently and [illegible] covered with a flag, and the wounded attended [illegible] dressings were applied with the utmost despatch. By the time this was done it was 1.15 p.m., and the action had [illegible] hour and a quarter.

I went [illegible] the fore-bridge and asked the Captain's permission to [illegible] bay, but he informed me that that would be im[illegible] were out of the danger area. So the wounded [illegible] comfortable as possible, and the dead were taken to the [illegible]. All cases were suffering exceedingly severely from [illegible] which was [illegible] by giving each of them ¼ gr. morphia [illegible] and cocoa, and applying hot bottles and [illegible]. After a little most of them became quite comfortable [illegible] went to sleep. There was a complete absence of [illegible] complaints.

[illegible] I got permission to open the sick bay, and on my [illegible] absolutely no damage to the compartment, although there was considerable damage to breakable stores from [illegible] of the guns.

The [illegible] having been cleaned and rigged, the cases

were br[illegible] me by one, thoroughly [illegible] dressed and [illegible] As we expected to [illegible] that same night [illegible] ive work was undertaken [illegible] tion an officer who [illegible] an anæsthetic and [illegible] wounds stitched up The wounds were so numerous that [illegible] over an hour to close and dress By 7 30 p m everything necessary had been accomplished and all the patients were [illegible]

Cases of Interest

(1) An officer Although he was only scorched on the upper part of the face and had a chip fracture of the left ulna the shock was very severe It was probably chiefly mental but in spite of all sorts of restoratives some three hours elapsed before I was sure he was out of danger

(2) An officer Both legs were severely scarified, and there was a lacerated wound of the abdomen just below the xiphi-sternum as the result of having a milled nut of the Dumaresq pointer forced into him by the concussion A rough examination made it probable that the parietal peritoneum had not been torn but the question was doubtful, and I had considerable anxiety as to whether it was fair under the conditions to submit him to the risks of an exploratory operation on board ship, or to leave him Ultimately he was left and, as it turned out, has done well

All wounds were treated either with iodine or pure carbolic the skin surface being washed with rectified spirit before the application of the iodine It is my opinion that the pure carbolic caused dry gangrene to take place in a large proportion of a large flap wound on the inner side of a knee

The burns were treated with picric acid dressings, but became very rapidly septic

The explosion of the shells caused a black oily sooty deposit in the skin of nearly all these patients This was readily removed with turpentine but nothing else seemed to have any effect Soap and water and spirit were useless

Three wounded had each an injection of 8 min of antistreptococcic serum This was given about 7 p m and the reaction next day was very marked, causing temperatures of 102 to 103° F with rapid, full and bounding pulses, headache and general malaise I cannot give any opinion as to its value

The Neil Robertson stretchers were of great service and it would have been almost impossible to remove the injured men without their help

SOME EXPERIENCES IN A HOSPITAL CARRIER

By Sir [illegible]

THE ss "Munich" had been on Channel service with orders to proceed to Calais and convey Belgian wounded to Southampton. The staff consisted of myself, Surgeon Lloyd, Surgeon Harvey and fifty Royal Naval Auxiliary Sick Berth Reserve Ratings. We arrived off Calais about 1 p.m. and were met by a tug ordering us to proceed to the rescue of a ship that had been torpedoed. We at once proceeded at full speed to Cape Grisnez and there found the Belgian refugee ship Amiral Ganteaume surrounded by all types of vessels. As there was no obvious need of any assistance we returned to Calais and finally secured at about 8 p.m.

The evening was spent examining the ship and devising the easiest method of stowing the wounded. From this point of view the "Munich" was extremely inconvenient. The available accommodation consisted of about 200 two- to four-berth cabins and only two open spaces, the saloon in which there was room for about thirty-two stretchers, and the smoking room with room for sixteen. The final decision was that it would be necessary to man-handle the majority of the stretcher cases into berths, only the very severely wounded cases being left on their stretchers. We had a stock of mattresses, and in one or two cases many were placed on these as their stretchers became uncomfortable. Generally speaking they showed no wish to be moved, and for such a short journey it appeared to me that the fewer times the bad cases were moved the better. Whilst referring to this, I may say that the cases were handled extremely carefully and gently by the auxiliary sick berth staff, very little discomfort being caused, even though in many parts of the ship patients had to be carried along narrow corridors and round right-angled corners. We unpacked all our stores, cleared out a cabin and used this throughout as a central dressing station, all gear removed having to be returned there, this was extremely necessary, as with so many different cabins articles were liable to be mislaid.

The next morning I was requested by Colonel Alexander, R.A.M.C., the Medical Officer in charge, to assist in loading the "Jan Breydel" [illegible] Royal Army Medical Corps orderlies were striving valiantly to cope with a number of wounded as they arrived. We put about 300 wounded on this ship, and then

[illegible] ship We took [illegible] ses, the [illegible] had had practically no medical atten [illegible] All cases were met on the jetty as they [illegible] nquiry was inquired into, and if it was [illegible] them on the stretchers a red label [illegible] By this method each batch of stretcher [illegible] the ship knew at once whether the cases could [illegible] not and as none of them spoke French the [illegible] ally accompanying each case on board and giving [illegible] nstruction [illegible] vided The ship was filled in sections with a petty offic [illegible] charge of each he reported at once as soon as his [illegible] ation was [illegible]

The majority of the cases arrived in private open cars with two [illegible] tal cases perched up on the back at first sight it looked very [illegible] but practically it worked very well The cases were carried [illegible] aboard by a working party of Belgian soldiers, and the majority [illegible] straight from the train In a few cases dressings had been [illegible] at the station but during the actual rush these were few and [illegible] tween and the majority had had their last dressing on the [illegible] In the last trip we made, the cases came straight from the [illegible] s and were in a much better condition

During the [illegible] week to which the English ships were assisting [illegible] val of sick and wounded 7 000 were taken out of Calais, [illegible] ght on to this all the hospitals in the town were full We [illegible] ambulating cases at about 9 p m and sailed the next day [illegible] Southampton arriving there at 8 p m and at once started to [illegible] boat Having previously been at Southampton for disem- [illegible] on duties I can testify how rapidly and efficiently this was [illegible] Trains were ready waiting in the sheds, a volunteer Red [illegible] staff provided the men with warm drinks food cigarettes, [illegible] s one train departed another one took its place At first all this work was done by the Royal Army Medical Corps, but afterwards they were assisted by the Naval Medical Service, Staff Surgeon Nicholls being in charge

On our next trip we brought over 431 cases, 240 being brought on board in stretchers and on the third and final trip 102 cases were brought over of these 104 were stretcher cases By the time we arrived at Southampton I always noticed that the number of our [illegible] cases had diminished, the twenty four hours rest and [illegible] effect of coming over to England proving very efficacious

The feeding arrangements were managed entirely by the Ship's

consisting mainly of tea coffee bread and [illegible] ch Beef sandwich Lentil soup &c. The [illegible] plates &c were rather heavy We spent much [illegible] Southampton that replenishing stores was very [illegible] first trip the Royal Army Medical Corps kindly [illegible] necessaries and we also obtained stores from the [illegible] nch Red Cross at Calais

[illegible] on the first trip showed that with the ship rolling [illegible] of the fetchers were liable to get on the move, so at Southampton I had battens fixed to the deck in the saloon and smoking room adjusting these so that there was just enough room for the legs of the longest stretcher to go between them any shorter ones could easily be fixed with cushions or mattresses

Having discussed the ship arrangements, I will now give a brief description of some of the types of cases carried Unfortunately I am unable to discuss these in any detail, as when the ship was filling up or actually *en route* the amount of work to be done only allowed one to make mental notes of some of the cases treated

The cases brought over were surgical and all moderately severe The wounded were very anxious to proceed to England, but a rough examination was made of what appeared to be slightly wounded cases and I refused to take any that we considered would be fit again within twenty one days All medical cases and slightly wounded were sent to Cherbourg or else attended to on the local hospital ship The wounds were almost entirely caused by shrapnel shell or bullet there was only one bayonet wound

Bullet Wounds.—Generally speaking the damage caused by bullets was much less severe than the shrapnel wounds, in the majority of cases these were clean wounds of entry and exit, and the injury was comparatively slight Bullets passing through soft tissues always caused a moderate amount of swelling of the part due to blood effusion and the inconvenience caused was mainly muscular In cases however, where bullets had struck bones there was often extensive laceration One patient informed me that he had been hit by an expanding bullet, in his case it had entered through the right cheek and struck the left side of the lower jaw removing the greater part of the left side of the face Injury showed that this was undoubtedly one of those cases in which the bullet had been fired at short range, and on meeting with an obstacle turned on its axis and travelled sideways, the final result closely simulating that of an expanding bullet

Surgical Work.—In the majority of cases the damage done by this war [illegible] were nature, the tissues being greatly lacerated. Almost without exception these wounds were septic and infected. Before entering into the question of treatment here I may remark that on going into a ward it was usually easy to tell if wounds were gangrenous or not without removing the dressings, the smell being quite characteristic a sweetish putrid type of odour. Many of the cases showed multiple injuries, and a large number of the wounds were in the back of legs &c. due to shrapnel bursting overhead when the men were lying down in trenches or on the ground. It was very interesting to see the extraordinary, and, from the patient's point of view, lucky route taken by some of the pieces of shell. Two cases may instance this. A Belgian cyclist was struck by a piece of shrapnel in the back of the neck about the level of the sixth cervical vertebra; in some inexplicable manner this travelled upwards and forwards without causing any marked injury to the tissues, and we removed it finally from the subcutaneous tissue in front of the left malar bone. It was a perfectly circular piece of metal about the size of a large marble. A sous officer was struck on the outer side of the left arm about the level of the deltoid insertion; on his ticket it was stated that the left humerus was fractured, but I could find no signs of this. From this position the fragment of shell travelled subcutaneously across the front of the chest, and we removed it from in front of the right pectoral. How it had avoided entering the chest I cannot imagine.

Two cases died on board, one from general peritonitis following a bullet wound of the abdomen, and one was a case of *emphysematous gangrene*. This case was under the care of Surgeon M. I. Lloyd, and I am indebted to him for a description of the symptoms. The patient had been wounded in the lower third of the left thigh by shell splinters, the joint being opened, the muscles of the leg were badly lacerated and the wound offensively septic. The thigh above the wound was discoloured and much enlarged, giving a crackling feeling to the touch. Just before death the lower part of the abdominal wall on the same side was becoming emphysematous. In the upper part of the thigh there were a number of bullæ on the skin filled with a brownish red fluid; the patient showed considerable jaundice and was tender over the liver. He died quite suddenly on the same day we took him on board. On all our trips we carried a Belgian priest, and the work he did was most excellent. He was trained in first aid, and was extremely useful in comforting some of the Flemish cases and explaining the necessity for dressings and small surgical precedures.

[illegible] — At least twenty of [illegible] cases must have [illegible] practically all of them it was purely [illegible] part of the body wounded seemed to [illegible] I think the majority of such cases were [illegible] back The worst case was a man wounded in the right shoulder I passed a soft catheter and drew off two and a half pints of urine on the morning, one of these afterwards the total amount drawn off was 18 oz

Traumatic Anæsthesia —We had two cases of this the origin in each case being the same—the men had been blown up by Jack Johnsons without actually being struck by any splinters Their nervous condition was most pitiable, and they shrieked with pain on being touched One case kept his limbs in such a strained ordinary positions that at first I thought he had fractured both femurs but examination showed no signs of any injury There were no signs whatever of any bruising and it had had ample time to show itself under the skin They were both insistent in their demands for *une pique de morphine*, having obviously had this at the field hospital in each case a syringeful of *ayan pura* sent them to sleep within about fifteen minutes

Paraplegia —We had one case It followed the explosion of a shell in the vicinity of the man, who was blown backwards into a trench, and found immediately afterwards that he was unable to move his legs There was paralysis of both legs muscles being rather flaccid reflexes were obtained but were greatly diminished Sensation was difficult to obtain accurately, the patient being [illegible] and not understanding French but as far as could be made out cutaneous sensation was almost abolished deep pressure was painful No girdle hyperæsthesia could be demonstrated there was no trouble at all with the sphincters This case could not be followed up but was probably one of the transient type of which so many have been described since the commencement of the war

Secondary Hæmorrhage —The one case we had demonstrated the difficulty of nursing wounded in a large number of separate cabins Luckily there was another patient in the cabin who [illegible] that something was wrong, shouted for the attendant The latter found the patient was bleeding profusely from a wound in the thigh and at once applied pressure to the common femoral I saw the man almost immediately after this and put on a tourniquet there was a pool of blood in the bed nearly 1 in deep the patient was pulseless and had marked Cheyne Stokes breathing

[illegible] appr[illegible] dand by [illegible] the p[illegible] rapidly [illegible] As we [illegible] at [illegible] sent the [illegible] ght to Not[illegible] amb[illegible] had others [illegible] the tommy[illegible]

[illegible] Chest and [illegible]—One could [illegible] from [illegible] by the few symptoms the majority [illegible] showed [illegible] the bullet entered through the [illegible] and came [illegible] the pulse there was a small [illegible] from which [illegible] was trickling but beyond this the [illegible] have no sequelæ whatever Cases with bullets [illegible] chest were [illegible] spitting up a little white frothy phl[illegible] not appear [illegible] bronchospasm

Multiple [illegible]—I will [illegible] one case as [illegible] extraordinary [illegible] of the wounds This [illegible] a Belgian priest [illegible] struck by a shell when he [illegible] wounded from the [illegible] He had compound [illegible] thigh and right [illegible] and many [illegible] of the [illegible] many smaller wounds [illegible] the head and neck His [illegible] splinted with [illegible] and [illegible] this away [illegible] Liston As he [illegible] pale with teeth [illegible] to see if he was [illegible] found that he [illegible] to the [illegible] to the ankles He was [illegible] for an [illegible] and [illegible] bath so he was lifted on the blanket and [illegible] beneath cut a hole in it so that the priest could [illegible] At this we [illegible] him egg milk and brandy every two hours [illegible] water every hour and he showed marked improvement [illegible] probably no actual bleeding but he was suffering from [illegible]

Treatment in General—This was continued almost [illegible] first and all the patients we possibly could write [illegible] ticketed to show the time and date this was [illegible] Morphia [illegible] not spared it all in cases where there was [illegible] and the majority of the cases had had it at the field [illegible] previous to [illegible] In some cases we found specks of [illegible] were rapidly efficient when the necessity for morphia did not seem so obvious all morphia cases were ticketed with the date time of administration and the amount given In one or two cases pieces of shrapnel were removed where they were [illegible] pain or inconvenience The majority of the fractures will put up again a large number of them had been put up merely with strips of lead foil moulded round the limb In one or two cases it was extremely difficult to remove the dressings owing to [illegible] tight bandage which

had been put on [illegible] of the bandage were completely finished [illegible] greatly assisted in the dressings by [illegible] November 12 we paid off the Bel[illegible] line and the number of wounded available [illegible] tion of the various ships of our class.

I think I can safely say we all regretted leaving [illegible] the work was extremely interesting, and the [illegible] for us anything one could do for them. As pati[illegible] nificent bearing what must have been extreme [illegible] the most plucky manner.

[illegible] SEVERE FEBRILE OR UNDULANT OR MEDITERRANEAN FEVER[1]

[illegible] [illegible] [illegible] SMITH C.B. F.R.S.

[illegible] of the Royal Society [illegible] of this disease it seems [illegible] that I [illegible] review the work that has been [illegible] many [illegible] parts of the world since [illegible] and to [illegible] out the findings of the [illegible]

[illegible] a variety of names, giving [illegible] views. The terminology [illegible] geographical basis those [illegible] it are chiefly personal [illegible] the first in that the [illegible] of the endemicity [illegible] knowledge. How [illegible] received a local name [illegible] was met with first and later has been [illegible] prevalent? [illegible] only unique to the [illegible] may appear, but in the case of Malta [illegible] Gibraltar, in South Africa, Geographical [illegible] investigation proceeds [illegible] to be dropped.

[illegible] have [illegible] been brought forward as [illegible] Many [illegible] have [illegible] or no septicæmic [illegible] and [illegible] might apply to more than one [illegible] *Melitensis* of [illegible], or [illegible] by [illegible] fever has been [illegible] this name would unite together all fevers [illegible] produced secondarily by them—increasing [illegible] the chronicity of the disease, more [illegible] prudent [illegible].

[illegible] Congress of Medicine held in London [illegible] question was discussed until it was [illegible] *Melitensis* was [illegible] satisfactory [illegible] by Hughes in 1897 [illegible] not limit [illegible] to those of the

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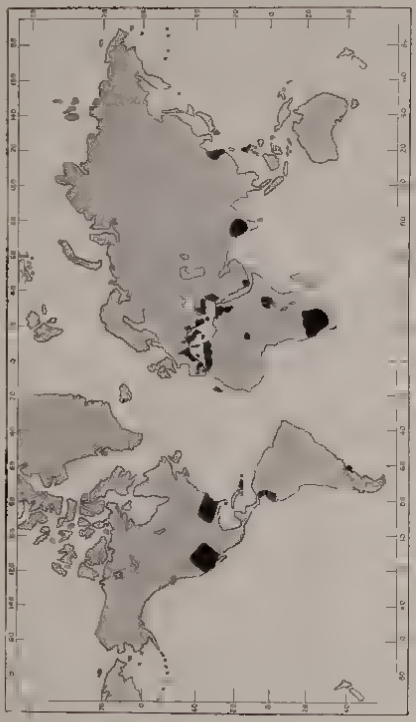
[illegible] Royal Medical [illegible]



Distribution of Malaria

most frequent clinical signs, it is euphonious, and is easily applicable to any language This term will therefore be employed by the writer

One may say, now, that the geographical distribution of undulant fever is world-wide undoubtedly one of the most important endemic centres was the island of Malta we found there the sources of supply in abundance, the presence of a continual stream of non-immunes was provided by the naval and military forces, and the hospitals were hotbeds of the disease No wonder therefore, that as a nation we were interested in the discovery of the cause and methods for preventing a fever which annually caused such a high rate of invaliding off the station, and so many days sickness to the fighting force

We now know that the fever is widely spread all round the Mediterranean littoral—in Spain France, Italy, Greece, the Levant Egypt Tripoli Tunis Algeria—and is present in most of the islands of Sicily, Cyprus, Candia Sardinia Corsica, &c It is not the case that casual inhabitants are affected in these places as believed by SHAW, but the disease is endemically present in most of them During the past few years the extension of the disease into districts far from the sea has been shown to exist In Spain by DE CORTES, DURÁN, RAMON Y CAJAL and SHARLZ In France by CANTALOUBE and WURTZ In Italy by SANGIORGI and GODINI In Portugal by BETTENCOURT This extension inland is a most important epidemiological factor and is in agreement with the findings of the Commission and the view long held by ZAMMIT that inland villages may be as heavily infected as those near the sea

If we leave the Mediterranean area and go east the next recorded endemic centre is in Northern India in the Punjab as originally demonstrated by LAMB going further east there is no doubt that cases occur in China which are probably of endemic origin but very little real scientific work has been carried out there, at least that I know of to prove the means of infection for milk is an article of diet is but little used except at Hong Kong and Shanghai, where the dairies are well supervised Most of the cases have been reported from the Yangtze region In the Philippines many cases have been recognized by CRAIG and others, the disease being conveyed by the sick soldiers to the United States of America

In Africa besides being found in the northern states cases have been reported from the Sudan, Blue Nile Lake Chad, and

Uganda, and it is a well-known fact that during and after the Boer War the disease became very prevalent in South Africa the Transvaal and Orange Free State, that is when the cattle were few and more goats milk was used. German South-west Africa is now included in this large endemic region. In America there appears to be a true endemic centre in Texas of considerable antiquity (Mohler) extending into New Mexico. There is probably also a small centre of infection in Peru (Vilet).

Wherever the disease is endemically found, goats in herds are practically always present and though the Maltese goat which has been widely exported on account of its great milking value, is the most frequent offender, yet other goats are equally susceptible of the infection and able to distribute the disease in Italy South Africa and America.

It may be of interest to say a few words about the so-called Maltese goat. *Capra hircus* is the stock from which the domestic Theban or Egyptian goat has been derived. These from change of environment have undergone considerable modifications and are locally known under other names—as, for instance our Maltese goat. The head is small, the ears are about two thirds the length of the head and rather narrow, but never so pendulous as in the Theban goat. Horns are often absent. When present they are small and crumpled. The tail is very short and erect. The udder is very large, sometimes reaching to and touching the ground so that animals walk with difficulty. The hair is long and brushy, it may be pure white cream brownish or black. The best points are a hornless head a large udder and reddish black muzzle. A good goat should yield from 3 to 5 litres of milk. Lamb has suggested that undulant fever is primarily a disease of the goat which had its origin in the Persian hills and has been carried by these all over the world more particularly in tropical and sub-tropical climates. In temperate regions the goat is but little used for milking purposes therefore selective interbreeding is neglected and the udders become less developed. Thus explains the occurrence of the infection in Southern Europe Asia Minor India and Eastern Asia but not that of South Africa and tropical America where the variety of goat is different from that of Persia and Malta.

So much is said of the infection through drinking goats milk that we are apt to forget that other ruminants may carry the disease, and that the products of milk are often infective. We have long known that the *Micrococcus melitensis* is a very

dangerous organism to work with and that many inoculations in laboratories have taken place causing attacks of the fever, we also know that the organism has very considerable vitality outside the body The view that an infected milk supply is the chief source of the disease is upheld by recent statistics, the diagram shows the incidence of the disease in the Services after the use of infected milk had been stopped the sick list on board the ships of our fleet is small and our hospitals are practically empty of what was our greatest enemy in the Mediterranean This is so in the Services, but the view that other methods of infection are frequent is steadily gaining ground, and these may be summed up in the words of SÉJOURNANT that in urban areas the infection is generally through ingestion of infected milk but in rural districts the disease is commonly spread by direct infection or inoculation of infected soil or milk LLLGER describes how prevalent the disease is in Corsica, how it is widely disseminated by a few infected goats to others when they pasture in the hills how these goats may infect the dogs and goatmen with them, how when the goats are brought down to the towns at certain seasons they are milked mostly by women, how these women become infected through the hands by the organisms in the milk and how the greater part of the milk is converted into cheese which is eaten fresh and in which the micro organism will retain its vitality for fourteen days.

Another epidemic near Rome is described by DELLA VIDA which shows how one infected goat gradually spread the disease in the local herds, how after a year (when abortions in this herd were noted to be frequent, the only sign of infection) cases occurred among those people associated with the most infected herd, and spread quickly amongst them when once started These people who lived under bad hygienic conditions, did not consume the milk but acquired the disease by inoculations or direct contact with the sick

A further point which was originally demonstrated by SHAW and has lately been brought forward by MISSIROLI and SANGIORGI is the danger caused by ambulant human cases these may be passing out the micro organism in the urine infecting the soil and outhouses, and conveying the disease to those employed in these places

As in typhoid one must look to the three F's—food, fingers and flies—as possible carriers of the organism Children at the breast are rarely infected directly TOMASELLI believes that they

possess a certain amount of immunity, but infants do sometimes show signs and give positive serum reactions as shewn by Longo at Catania, and Luna of Palermo, in fact, the latter thinks that cases are more common than can be inferred from the number reported because many are not recognized. As the *M. melitensis* has been shewn by Eyre to be present in the milk of infected mothers this is probable.

At Kleber in Algeria, Sergent describes a small but interesting, human epidemic. In one family four out of five were attacked. These possessed no goats, and drank only boiled milk from an uninfected source. All the members, including the goatherd, of the family which had lived in the house previously had suffered from the fever. In this instance the infection was believed to be a purely local one, due to the contamination of the house and sheds before the owners took possession.

In descriptions of the infecting micro-organism there is again much discrepancy. Hiss and Zinsser go so far as to call it the *Bacillus melitensis*, others call it a cocco-bacillus, some say it is motile and describe flagella as being present. From a very large number of examinations I believe the organism to be a true coccus, often under cultural conditions seen as diplococci due to the division of the cocci. In old cultures bacillary forms are common, these are involution forms and favoured by different media. Where growth is vigorous, long chains tend to be present made up of diplococci: this streptococcic character is like that which occurs in the culture of the pneumococcus and is morphologically interesting (Bassett-Smith). The *M. melitensis* according to Florentini is able to produce a toxin which acts as a hæmolysin.

Pathogenicity.—Eyre and others have shown that besides monkeys and goats, horses, dogs, rabbits, guinea-pigs, rats and mice can be experimentally infected. Rabbits, after subcutaneous inoculations with living cultures of the *M. melitensis* will give a serum having a high agglutinating power, but a true septicæmia does not appear to be produced as the organism cannot be recovered from the circulating blood: these animals were found by Eyre to die in about six months. Two animals I have used for this purpose reacted up to 1 in 2,000 but have gradually lost these agglutinating reactions and have made complete recoveries. Guinea-pigs are not generally affected, unless the pathogenic power of the organism is raised and the injections given intra-cerebrally. In rats and mice antibodies are formed in small amounts or not at all.

The infection may be naturally acquired by man goats cows sheep horses mules and dogs

In 1912 NÈGRE and RAYNAUD while testing various strains of the micrococcus in their laboratory at Algiers, found one that though it gave the morphological and cultural characters of the type yet was able to agglutinate only with very low dilutions of serum rich in antibodies for the type On working this out it was found that animals injected with this strain produce a serum rich in antibodies for itself but which only agglutinated other strains in low dilutions It is also possible to remove the antibodies for one without affecting the other as shown by absorption tests This variety which had been suspected by ZAMMIT is therefore distinct from the type in its serum reactions and is described by NÈGRE and RAYNAUD as *M paramelitensis* The strain had previously been known as *M melitensis* BR It is a curious fact that this strain had been originally isolated by BRUCE and had been kept without its peculiar characters being recognized in the laboratories of Algiers and Tunis from which places sub cultures had been widely distributed to other laboratories in Europe—thus probably causing many of the errors in diagnosis which have been so frequently reported

In 1913 I was able to report a very prolonged case of fever in a lady, contracted at Hyères, in which though the symptoms were those of undulant fever no positive reactions could be obtained The serum was tested in many laboratories and by different experts when the blood was tested with the paramelitensis strain it reacted up to 1 in 400 Human infections therefore exist as well as animal

In the routine examination of goats in Algeria, SEJOURNANT reports that out of 490 tested, in only 20 were positive lacto reactions obtained 11 of these were with the *M melitensis* 9 with *M paramelitensis* and 2 with both and he found that most of the infected goats had been received from Spain The frequency of the infection of goats by the paramelitensis strain is of great importance

If we now turn to the methods of diagnosis, those for animals and humans must be separately considered From the work done by the Commission, it was recognized that in the diseased animals there was a general infection of the blood, spleen, liver, kidneys as well as in the lymphatic system especially affecting the deep glands. The specific micro organism passed out of the body in the urine, faeces and milk From the urine and milk more or less pure

cultures could be frequently obtained, thus giving definite evidence of the disease. The lacto reaction as introduced by ZAMMIT and HORROCKS came to be the most readily and generally used method for detecting the infected goats, and this could always be controlled by serum reactions or other more certain methods. A table of the percentage of infected goats in the different localities made out in 1912, is thus given —

Malta, ZAMMIT	50 per cent
Algeria, SERGENT	3·4 ,,
Tunis, NICOLLE	30
Marseilles, CONON and HUON	34
St Marthal, Gard, AUBERT and CANTALOUBE	29

Recent work tends to show that in many of the infected goats there is a localization of the organism producing a mammitis without general septicæmia.

Some experiments carried out by VALLET and REMBLAND were made on various laboratory animals with reference to the agglutination reaction. They found that with healthy guinea-pigs reactions were not obtained in higher dilutions than 1 in 20, in rabbits it rose to 1 in 50, and in twenty one healthy dogs eighteen reacted in dilutions varying from 1 in 20 to 1 in 400. Heating the serum always prevented these reactions. MARTEL TANON and CAUFIN state that heating the serum does not always prevent chances of error and that it is indispensable to carry the serum agglutination test for goats up to 1 in 100. Also that reactions with milk are too variable to be used for diagnosis.

I have tested the serum of rabbits and guinea-pigs with the following results —

Rabbits	1	2	3
Unheated serum	+ 1 in 20	–	–
Heated serum	–	–	–

Guinea pigs	1	2	3	4	5	6	7	8	9	10
Unheated serum	–	–	–	–	+1 in 20	–	+1 to 20	–		
Heated serum	–	–	–	–		–	–	–	–	

All the reactions were cut out by heating the serum.

These anomalous reactions have frequently been described when examining goats milk and though the lacto reaction is generally carried out as a means of diagnosis it is not always reliable and is rarely alone depended upon for prophylactic purposes. It is however of very great assistance to the sanitary officer. Cows in the endemic areas by means of lacto-reactions have frequently been noted to be infected, and in London KENNEDY obtained positive reactions in three out of twenty two cows.

TABLE I.—Milk direct from Individual Cows

Dilution 1 in 2

No.	Unheated			Heated		
	Microscope		Sed.	Microscope		Sed.
	½ hour	1 hour		½ hour	1 hour	
1	–	+	+		+	+
2	–	+	+			+
3	–	–	+	–		–
4–16	–	–	–	–	–	–
17	+	+	+	+	+	+
18	+	+	+	+	+	+
19	+	+	–	–	–	–
20–26	–	–	–	–		–
27	–	–	+		+	+
28–31		–	–			
32–37	–	–	–	–		–
	3	6	6	2	4	5

Dilution 1 in 20

17–37	–	–	–	–	–	–
	0	0	0	0	0	0

It is of the utmost importance to recognize that the reaction is a specific one and that by its means an enormous amount of public health work for the prevention of the spread of undulant fever is possible. It is therefore very important to find out the causes of error which may lead to very misleading results. I have in the laboratory at Greenwich examined a series of milk samples obtained locally, some direct from individual cows and some mixed samples of milk from different dairies. Five different strains of this *M. melitensis* were used, the emulsion being made from cultures not more than forty-eight hours old and the results were read both microscopically and by the sedimentation method. Controls with out serum, with normal serum, and with serum from an unimmunized animal were used. It was found that boiling the milk cut out all the reactions and heating for half an hour at 60° C. cut out some

but not all. A total of 69 samples were tested, 37 were direct from individual cows and 42 were samples of mixed milks from different dairies. With a 1 in 2 dilution there were six positive reactions out of 16, with a 1 in 20 dilution there were no positive reactions in 21 milks examined direct from the cow.

TABLE II.—Mixed Milk from Different Dairies.

No.	1 in 2			1 in 20		
	Microscope		Sed.	Microscope		Sed.
	½ hour.	1 hour.		½ hour.	1 hour.	
1	−	+	+	−		
2	+	+	+	−		+
3	+	+	+			+
4	−					+
5			+			+
6	−	+	+	−		+
7		+				+
8		+				
9						
10			−			
11						
12		−				
13						
14–22						
23	−	−	−			
24	−	−	−			
25–32		−				
						−
	5	14	12	1	0	11

With thirty-two mixed milks there were 12 positive reactions with a 1 in 2 dilution, and eleven with a 1 in 20, the highest agglutination obtained was 1 in 100.

When the milk is kept the reaction may quickly change as shown in Table III. A sample of milk direct from the cow gave a complete negative reaction to all the tests when examined at once, but in thirty-eight hours it had turned to positive in a dilution of 1 in 20.

Five samples from individual cows which had given positive reactions in low dilutions were plated out for the isolation of the

M melitensis, but without success No serum could be obtained from these animals, but they were stated to be in good health

By using a forty-eight hour culture for the emulsion and a dilution of 1 in 20 no positive reactions were obtained from the milk of twenty one cows examined quite fresh, but after keeping and in using mixed samples a high proportion reacted positively in that dilution It is very necessary to centrifuge the milk very thoroughly or use whey and to heat it for half an hour at 60° C There is no doubt that cows milk in some cases has a tendency to agglutinate the *M melitensis* but if care is taken most of these non specific reactions may be avoided The absence of any endemic undulant fever in London is strong evidence against there being any true infection of the cows

TABLE III —Milk direct from Cow No 4

1st Day

Dilution	Unheated			Heated		
	½ hour	1 hour	8ed	4 hour	1 hour	8ed
1 in 5		–		–	–	
1 in 20			–	–	–	–
		2nd Day				
1 in 5		+	+			
1 in 20		+	+		–	–

Showing change for time

In man the diagnosis is made with most certainty by cultivating the organism from the blood, this is generally successful in early cases with well marked fever, when an advanced cachectic condition is present this procedure will often fail From 1 to 5 c c should be drawn off and distributed into two flasks of nutrient broth from which sub-cultures into agar can usually be obtained about the third day The agglutination reaction with the serum is the most common diagnostic method either observed microscopically or by means of sedimentation tubes Using unheated serum, Carrieri and Angiady found that with certain strains of *M melitensis* non specific reactions may occur in dilutions from 1 in 10 to 1 in 200 but with specific sera these variations with different strains were very slight they therefore recommend that for diagnosis a serum should be tested with many strains before a conclusive opinion can b

formed This is not my view I think by giving a [illegible] of known agglutinable power and using all precautions errors will be very few I therefore use a forty eight hour agar growth From this a strong emulsion is made Allow any auto clumps to settle and pipette off the clearer part for use Have two tubes of serum one heated to 57° C for half an hour and one unheated test each in dilutions of 1 in 10, 1 in 100 1 in 400 microscopically and by the sedimentation method I place the latter tubes in the hot incubator for two hours and then read off they are next set aside in the cold for twelve hours and a final reading taken For controls a known specific serum and a normal blood should always be used

Out of sixty-five control sera used by myself and tested with five strains of *M melitensis* in only one was there a positive reaction In a series of 150 sera from patients in Hustar Hospital in 1907 suffering from all kinds of diseases, four gave positive reaction In these four a careful history shewed that they had been under treatment at Malta Hospital or had previously suffered from the fever

Ruschfse states that Widal in his laboratory caused an emulsion killed with formalin (2 drops to 15 c c) to be used This was safer and acted quite satisfactorily keeping well for over a year Thirty sera of cases suffering from febrile conditions other than undulant fever were tested with this emulsion and all gave negative reactions

Agglutination reactions for undulant fever have not infrequently been found to give uncertain results These errors are largely due to the use of unsatisfactory cultures, or serum which has undergone changes the presence of non-specific agglutinins or to errors of technique Nicolle showed that a possible source of error exists in the removal of the agglutinin from sera by long contact with the clot He therefore recommends that the serum should be pipetted off and stored for use if not required to be tested at once That this is not always the case I showed by testing a blood which had been collected four years previously and which still reacted well in dilutions up to 1 in 200 It is, however very advisable to use the clear serum if possible

When carrying out the reaction the following points should be remembered —

(1) The culture to be used should be proved to be active with known specific sera and should not agglutinate with other sera The use of a paramelitensis strain would fail to agglutinate in high dilutions with a true undulant fever serum and give rise to a negative error

(2) As recommended by Nigay and Raynaud, the heated and unheated serum should be tested the former cutting out the non specific agglutinins and preventing a positive error in non undulant cases

(3) The test should always be carried to high dilutions up to 1 in 400 to avoid paradoxical reactions

A second sero diagnostic method which can be used is that of complement fixation This has been employed extensively by Missiroli and others and I have found it to give good reactions it acts as a very efficient control to the agglutination test, but the value of different strains of *M melitensis* as an antigen often shows great variations Cases may sometimes fix the complement well and give unsatisfactory agglutinations

Vigano has lately brought forward a precipitin test as a diagnostic procedure but this is unlikely to act when the disease cannot be recognized by agglutination methods

In order of their relative value for diagnosis we have then (1) Sero culture (2) agglutination (3) complement fixation, (4) precipitin test (5) culture of the organism from the urine

The difficulties of making a clinical diagnosis are constantly being brought forward owing to the irregular character of the symptoms, the long duration of the disease, and the presence of certain abortive forms This is noted particularly in country districts of Spain Italy and Africa, where the disease is but little known amongst the local practitioners Cases are frequently diagnosed as typhoid, paratyphoid septic, and gastro-intestinal infections, among young children these errors in diagnosis are most common Trotta and others have shown that the micrococcus may occasionally act as a pyogenic organism causing suppurative arthritis and local abscesses As in typhoid infectious node like swellings on the sternum and ribs have long been known to occur in undulant fever due to a tissue necrosis caused by the micrococcus Chronic cases are easily mistaken for early conditions of infective arthritis deformans In Texas and New Mexico the disease has been known as mountain or slow fever for at least twenty five years and is always found among people employed in goat rearing, the cases being most common after the kidding season during April May and June In German West Africa Summa states that the disease is now fairly common, but the cases are frequently diagnosed as malaria

In treating cases it is most important to remember that we have a very long and tedious disease to deal with as this is not

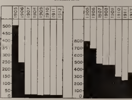
associated with ulceration of the bowel, it is therefore necessary to conserve the patient's strength as far as possible, and to give as much food as he can assimilate being guided mostly by the condition of the tongue and the height of the fever. As cardiac irritability is a common condition, antipyretic drugs for reducing the fever are generally harmful, and hydrotherapy is to be preferred. Insomnia is such a trying and common characteristic that it requires treatment: the patient should never be allowed to pass sleepless nights. Trional or other hypnotics should be given, or if pain is severe morphin may be used. Stimulants are not generally required in the early stages, but when cachexia is pronounced they often do great good. I have found preparations of yeast useful both to increase the number of the polymuclear white cells and hence assist in destroying the infecting micro organism, and also to reduce the tendency to the development of the neutrin which is so common in the later stages of the disease.

Scordo, experimentally, has obtained very good results by treating artificially infected goats with intravenous injections of perchloride of mercury, which gave rise to an increase in the corpuscular elements in the blood, raising the numbers of the red cells and the haemoglobin, also producing a polymuclear leucocytosis and sterilising the blood, thus cutting short the fever: if this can be accomplished in man the method will be of great value. Marshall has also obtained some good results in animals with "606," but these require confirmation, as rabbits may recover spontaneously if the infection is not very severe. Souma and others in German South west Africa have used intravenous injections of protargol as a germicide with success, but it is not free from danger, occasionally causing toxic nephritic symptoms and suppression of urine. Trambusti and Donzello by inoculating goats with a nucleo-proteid derived from the *M. melitensis*, have prepared a serum which is stated to have given satisfactory results when used early. Nicole and Sergent have also prepared and used a polyvalent serum with good results. Vaccines may be used with good results particularly in sub acute cases both for melitensis and paramelitensis infections. The annexed charts show examples of the rapid disappearance of the fever under vaccine therapy. The general improvement, as shown by an increased feeling of comfort and a steady gain in weight, is often very marked in these cases, and the opsonic index is seen to rise at the same time. This method therefore holds out considerable hope in protracted cases. It is possible that a polyvalent vaccine made from many strains of

[illegible] might give better results The use of sensitized vaccines also requires trial

For prophylaxis it is now generally recognized in endemic areas that the disease should be made notifiable, that local disinfectant methods should be carried out, that the importation of infected goats must be stopped, and that regular examinations of animals by competent persons must be periodically made In France, Italy and Northern Africa legislative action is strongly urged This has been taken in France and Algeria with good results

Undulant fever



In c[illegible] the Naval and Military [illegible] be properly [illegible] endemic [illegible] limited [illegible] inoculation [illegible] and [illegible] undulant [illegible] of the disease [illegible] disinfection [illegible] and continuation [illegible]

Historical.

JAMES LIND
PIONEER OF NAVAL HYGIENE

By H. D. ROLLESTON, M.D., F.R.C.P.
Consultant Physician to the Royal Navy, Royal Naval Hospital, Haslar; Senior Physician, St. George's Hospital.

The abolition of [illegible] in the Navy [illegible] 1796 was a step [illegible] preventive medicine [illegible] control of malaria [illegible] Lind is now little [illegible]

He was born in Scotland on 17th [illegible] not appear to be [illegible] related to another [illegible] (1736–1812), M.D. [illegible] medicine in the Dictionary of National Biography, [illegible] for when quoting his own [illegible] he describes him as [illegible] He began his medical career on December 22, 1731, [illegible] registered apprentice to

George Langlands [illegible] Royal College of Surgeons of Edinburgh from 1739 to 1748 he was [illegible] in the Royal Navy, and in this capacity visited Minorca, the Coast of Guinea, the West Indies and the Mediterranean. Almost his first cruise was one of ten weeks in H.M.S. Salisbury under Commodore the Hon. G. Edgcumbe during which eighty out of 350 sailors were laid low by scurvy. This experience and the publication of the Rev. R. Walter's description of Anson's voyage round the world with its record of fatal scurvy in 75 per cent. of the crew, stimulated him later to write what was first intended to be a short paper for the memoirs of a Naval Medical Society, but grew into a book of more than 400 pages. In 1748 he returned to Edinburgh, where he took his M.D. degree, and on May 1, 1750, was elected a Fellow of the Royal College of Physicians. Of this body he became treasurer in 1757, only to resign the post on being appointed on June 1, 1758 to succeed Dr. G. Cuthbert as Physician to the Royal Naval Hospital at Haslar, four years after it was opened. During this ten years residence in Edinburgh he brought out his great works on scurvy and on naval hygiene which so fully justified his appointment to Haslar. The classical "Treatise on the Scurvy," dedicated to Lord Anson, appeared in 1754 and ran into a second edition in 1757 and a third in 1772, and was translated into French by Mere of Montpelier. In 1757 he brought out "An Essay on the most Effectual Means of Preserving the Health of Seamen in the Royal Navy," dedicated to his former Commander Lord Edgcumbe which also reached a third edition, the second (1762) and third (1771) being published by "Authority of the Lords Commissioners for executing the office of Lord High Admiral of Great Britain, Ireland, &c." It was translated into French, German and Dutch.

At this time the posts of medical officers to the Royal Naval Hospitals were on a different footing from those of the Navy, and were not necessarily filled from those who had served in the fleets[1] and the status of physicians was far superior to that of surgeons, who had but recently (1745) withdrawn from the ancient Company of Barber Surgeons in order to form a separate company. When first opened, in 1754, Haslar was only a third of its present size, but later, when the two side wings were in full working order (1762) the complement of patients was very large, in 1779 it was 1,900 thus providing an ample field for observation which Lind utilized to the full.

Lind's resignation of the post of Physician to Haslar, on account of the infirmities of age was sent in on June 18 1783 and was accepted on June 30, a minute being entered in the records to the effect that his salary ceased at midsummer.[2] The article in the Dictionary of National Biography, on which I have freely drawn, states that he remained Physician to Haslar until his death. This mistake is not altogether surprising as the same post was held successively by a father and son with the same initial. After the unequalled period of twenty five years (1758 to 1783) as professional head of the hospital James Lind was

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[1] In 1805 an Order in Council decreed that these appointments should be held only by those who had served in the public service afloat.

[2] For the extracts from the Hospital Records I am indebted to Surgeon General J. J. Dimmis, M.D. of the Royal Naval Hospital, Haslar.

succeeded by [illegible] appointed Assistant Surgeon to Hasbr on [illegible] and there presented to the Assistant Physician with [illegible] on July [illegible] additional grant of £30 [illegible] made on [illegible] same year. The [illegible] with after his first appointment [illegible] to London to pass [illegible]

During most [illegible] physician and [illegible] head his family [illegible] the Sick and [illegible] decision and [illegible] example. Con- [illegible] control him [illegible] difficulties of [illegible] both male and [illegible] victims [illegible] were constantly [illegible] Limits to be [illegible] council of [illegible] Sailors in London [illegible] official [illegible] was signed [illegible] July 24 [illegible] (of 1805) [illegible] 17[illegible] [illegible] last campaign [illegible] name of [illegible] duty to the [illegible] orders [illegible] Hospital in Minorca [illegible] and three [illegible] the new [illegible] discipline [illegible] on the [illegible] 1794 upon the [illegible] officers were [illegible] according to [illegible] were applied [illegible] shown by [illegible] humorous [illegible] to circulate [illegible] hand of [illegible] instead of [illegible] and on [illegible]

Immediately [illegible] For his [illegible] Sir H. D. [illegible] memorial tablet [illegible]

[illegible]

[illegible] 1783 Sir George [illegible] published [illegible] of his forms the first [illegible] the sixth edition of [illegible] accidental to [illegible] in Hot [illegible] indebted to [illegible] Cooper, [illegible] Hospital [illegible] his election as an honorary [illegible] Copenhagen who [illegible] apart from [illegible] have shared the fate of a prophet [illegible] famous in connection with [illegible] I shall attempt to show [illegible] clearly [illegible] its history nature, [illegible] notable chronological list [illegible] publications on this disease [illegible] importance of the subject the points [illegible] valuable lives in our fleets [illegible] Spanish arms and that the [illegible] means of preventing [illegible] occasion (probably in [illegible] her on the fleet coming [illegible] them they were lodged in [illegible] a prophylactic against [illegible] all manner and lemons [illegible] juice and lemon juice [illegible] as he mentions on the [illegible] employed oranges [illegible] further in 1593 [illegible] on scurvy, and in [illegible] Captain had equal [illegible] juice which was [illegible] pointed out by [illegible] even [illegible] of hospital (colchicum) [illegible] Asia Minor [illegible] the fourth century [illegible] was brought in [illegible] by Baron [illegible] agent in the famous secret [illegible] de Russon [illegible] gout [illegible] orange and lemon juice so that [illegible] In this process the puri[illegible] the constituent of a thick syrup [illegible] earthenware vessels gave rise [illegible] the joints on the leaden glaze

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[illegible] 85

[illegible] Volumes 1825 vol. [illegible]

[illegible] 1837 vol. i. p. 655

[illegible] 183[illegible]

[illegible] Mr [illegible] Surgeon to the Squadron [illegible] ships in the East Indies with an ample [illegible] the first time that I have recommended [illegible] Selected Dissertations on Several Subjects

Lind described this source of death in the pol
Edinburgh Medical Observations of May, 1751 Fo
passing that James Lind a surgeon of Barnstapl
put forward this notion of acid on the lead glaz
vessels as the way in which cider became impregnated and
modify to this extent the accepted view of Sir G
that the impregnation of cider with lead, which he pro
cause of Devonshire colic took place in the presses It
that the danger from keeping cider in glazed earthen
known to Baker Lind followed the practice of th
other detail, namely to allowing sauerkraut as a prophyl
tion was made from yellow cabbage the leaves of
November into thin slices and strewn in layers
covered with salt According to Lind all the cab
served are washed, their virtue is the same as
garden

Most unfortunately for the Navy forty one ye
recommendations as to the use of lemon juice
effect The state of affairs in 1791 is thus descri
for the prevention of scurvy the British Navy is
with sauerkraut elixir of vitriol malt and es
before fermentation) of the first he says that
which it has cost the Government of the
suggested by Mead and largely used in the Navy
free dilution to the grave he adds that it is
that it is insole
lemons oranges and limes but threw cold
advocacy of the preserved juice of lemons
that it failed in the hands of the famous Captain
to the southern hemisphere in 1773 4, and others
(1762) and that it underwent fermentation and
John Pringle however argued that the failu
the insufficient quantity used and tried though
his friend Captain Cook to give it a further
corrosively quantities to accept its value
terested with vinegar After just as before Lind
treatment various methods of curing and preventing
forward some of those being infusions of oil
he mentioned a mixture of vinegar and
(Fairloul) crystallized citric acid spruce
porter and cider and several writers stated that
for grog was followed by diminution of scurvy

It was Sir Gilbert Blane's powerful influence
Lind's recommendations into official use
medicine had to 1782 been instrumental in curing
on twenty eight ships of the line, by means of

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[1] Trotter Observations on the Scurvy Second
January 1792

Lettsom D A Treatise on Scurvy 17

Thomson J An Essay on the Scurvy London 1

oranges and as the outcome of his advice in 1793 to Sir Alan Gardner every seaman in H.M.S. "Suffolk" during a voyage of twenty three weeks in 1794 without touching at any port received two thirds of a pint once of lemon juice and 2 oz. of brown sugar daily with the result that scurvy did not appear on the ship. Blane, who had thus tested both the curative and prophylactic effects of lemon juice, gave the most full and generous credit to Lind, and was most emphatic that nothing in the least degree could compare with it. In 1795, a few months after Blane had been appointed a Commissioner of the Board of the Care of Sick and Wounded Seamen, an Admiralty order enjoining the use of lemon juice was issued. It is rather pathetic that Lind who died on July 13 1794 did not live to see the full fruits of his labours. The effect of this Admiralty order was almost magical. Scurvy at once practically disappeared from the fleets and Naval Hospitals, and the annual mortality of the naval sick sent to naval hospitals was halved. Thus, in 1797 Earl Spencer First Lord of the Admiralty, being at Portsmouth visited Haslar and was anxious to see scurvy, but there was no case in the hospital. This may be contrasted with the state of affairs in 1779 when the Channel Fleet after a ten weeks cruise in the Bay of Biscay returned to Portsmouth with 2 100 cases of scurvy. It is noteworthy that the first step in naval preventive medicine which took so long to accomplish almost coincided with the publication of Lind's long and patient work on Scurvy (1753).

It may at first sight seem strange that Lind's recommendations were so readily adopted, for they were neither boycotted nor ignored, rejected or being scouted as they sometimes rather coldly by most of the numerous contemporary writers on scurvy, and as has already been mentioned Lind's treatise went into three editions. Trotter, who published Lind during his lifetime is quoted on page 190 in 1803 expressing surprise that Lind had had so many opportunities of examining cases of scurvy after death and went on to say "the plain truth of the matter is, his method of cure was imperfect, for a man dying of scurvy is not known at the present day." It certainly is grossly unfair to saddle Lind with the blame for the results of the failure to carry out his injunctions for the prevention of scurvy. As proved in a previous sentence from a memorandum dictated on one occasion scorbutic sailors died while being conveyed from Spithead to Haslar. It does not appear that Lind's personality was such as to arouse antagonism, for the records of Haslar show that he was remembered as a man of peace. He had been a supernumerary in the Navy and there is no reason to suppose that his appointment to the post of Physician of Haslar aroused resentment or passive resistance among the naval officers of the Navy. Herbert Spencer used the interval of forty years which the Admiralty allowed to elapse before the return of Lind's recommendations as an apt illustration of the inertia and torpidity of administrative bodies. Perhaps the real explanation is merely that it failed to meet with the same prejudice and opposition that greeted with the introduction of Jenner's vaccination and Listerism commonly encountered.

Another practical reform in naval hygiene made by Lind was his simple method of obtaining potable water by distillation of sea water. He had long been known that distillation deprived sea water of its salt

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Spencer's Study of Sociology, Fifteenth edition, p. 102. Footnote 1880.

but as these [illegible] often always had a disagreeable taste [illegible] supposed [illegible] due to bitumen and a spirit [illegible] ingredients [illegible] Lapis infernalis [1] and calcined bones (Spirit of [illegible]), soap lees (British) or powdered chalk (Stephen Hales) were added to the sea water as preventives In practice however the [illegible] disadvantages Lind pointed out that this burnt (empyreumatous) taste which is common to all distillates, especially the first few ounces, quickly disappears on exposure to the air and he accordingly dispensed with the addition of any ingredient to the sea water before distillation In 1761 he demonstrated his method in Portsmouth to Mr Hughes the resident Commissioner of the Navy, and in May 1762 transmitted a full account of it to the Royal Society He employed the ordinary ship's boiler fitted with a pewter still head and a worm placed in a closed cask (worm tub or cooler) full of cold sea water which could be changed and when warm utilized to fill the boiler Fortune, however did not smile on his efforts for the improvement like many discoveries it was not only claimed by others but stated not to be original and to have been known to Sir F Bacon and Sir Richard Hawkins It must have been very galling when four years later Poissonnier a French author of a treatise on diseases of seamen received a considerable pension for the same improvement and again in 1773 when Irving, a surgeon in the Royal Navy was awarded a grant of £5 000 from the House of Commons for an inferior apparatus consisting of a large tin tube 6 to 8 in in diameter and 7 to 8 ft long like the funnel of a stove which was attached to a ship's copper and kept cool with mops, but was not provided with worms By an irony of fate Lind was placed on the Board which reported favourably on Irving's method and after first refusing gave in and signed the report That Lind's priority which Sir Gilbert Blane subsequently endorsed should have been thus ignored is rather puzzling for according to Lind the Lords Commissioners of the Admiralty published the second edition (1762) of his essay "On the most Effectual Means of Preserving the Health of Seamen" as an honour upon account of the important discovery I had then made of rendering sea water perfectly fresh and wholesome by a simple distillation'

Under the attractive title of 'A Means of Preventing a Want of Provisions at Sea,' Lind described the result of an impulse to discover the most nutritious substance which from its small bulk the stowage of which it could be prepared as food and its stability might be carried on board ships as a kind of emergency ration in addition to the ordinary victualling The articles he recommended were powder of salep (meal from the dried tubers of some orchidaceous plants) and portable soup which provide the maximum amount of protein and carbohydrate in the minimum bulk An ounce of powdered salep and an ounce of portable soup dissolved in two quarts of boiling water made a rich thick jelly and provided enough food for a man for a day

The familiar uniform of sailors appears not to have been established until 1807, although Clowes[2] quotes memoranda dealing with the naval

[1] Lapis infernalis was a synonym for nitrate of silver and Lapis prunella alkalinus for caustic potash which was presumably the ingredient used by Appleby

[2] Clowes 'History of the Royal Navy' 1901 vol vi p 210

[illegible] officers before this date, the earliest being in 1825 Before the [illegible] of the uniform the captain of each ship determined the style [illegible] slops —often somewhat piratical—of his crew It is [illegible] to that Lind urged that the seamen of His Majesty s [illegible] put into a uniform sea habit with some little movable [illegible] ns by which it might be known to what ship they [illegible] His object was to ensure cleanliness and to avoid infection [illegible] by muscles of clothing This suggestion was endorsed by [illegible] illustrated by Trotter who proposed that the uniform should [illegible] his jacket a waistcoat of white cloth trimmed with blue [illegible] ers and a small, round waterproof hat with a narrow belt [illegible] he'll e printed the name of the ship Trotter urged that [illegible] the sanitary advantages the adoption of such a uniform [illegible] tion more difficult

[illegible] p th differentiated at that time formed a very large [illegible] t the cases sent from the fleet to Haslar thus in the two [illegible] 17 S to July 1760—out of 5 743 patients admitted 2 174 w [illegible] fevers the next largest item being 1 116 victims [illegible] ubject of fevers the spread and prevention of infec [illegible] n the sphere naturally attracted Lind s practical and obse [illegible] He laid much stress on the importance of fresh air and ventil [illegible] t that the most tiny vessels in the hospital should [illegible] se He also pointed out that when fevers became [illegible] g tents or separate huts in open fields are far [illegible] upon of this open air method of treatment [illegible] which there were so many fever patients that some [illegible] and were therefore thought to be rather [illegible] s of the however recovered whereas the mortality [illegible] o others wards was very high He expressed [illegible] l position allotted to the sick on board ship, [illegible] the part of the gun deck called the bay which is the most [illegible] part of the ship or what is nearly as bad in the [illegible] the hold and characteristically ready with a practical [illegible] that in warm weather the most suitable place for the sick was [illegible] which if necessary, could be protected from rain [illegible] With emphatic as to the value of fresh air and cleanliness [illegible] the spread of infection he fully realized that these [illegible] not in themselves sufficient to destroy the infective agent and for this purpose he employed fumigation by tobacco burnt with junk or by charcoal [illegible] with sulphur or arsenic

He thus [illegible] studying jail fever (typhus) as it was common in the [illegible] often introduced by impressed men brought from Newgate and other prisons He says that it is a mistake to consider that [illegible] is sometimes confined to a very narrow [illegible] and he instances two marines who contracted it [illegible] the other from sleeping in the same bed Examples are [illegible] that the infective agent is carried in filthy clothes and rags

[illegible] Means of Preserving the Health of Seamen [illegible] p 7

[illegible] Nautica 1797 vol [illegible] p 48

prone in view of his wide experience to quote others in support of his conclusions. As a result his works though scholarly are sometimes rather laboured. His strong point was not originality, but sound common sense which enabled him to see the essentials clearly and to adapt or modify existing means to meet difficulties in a thoroughly practical manner. If we accept Broussais's dictum that 'the real physician is the one who cures' Lind's services to the Navy entitle him to a high place and a lasting fame in our profession. The following estimate of Lind during his lifetime from the pen of his somewhat critical contemporary Trotter may fitly conclude this slight sketch. 'The leading trait of his professional character has marked him the man of observation. When he first published his book he had no doubt many authors to consult, but their facts were often distorted their theories absurd, and their practice empirical so that much was left to himself, and when he came to be Physician to Haslar Hospital he seems to have soon formed his own opinions. Of great medical abilities that have attended military services the army of this country can boast of a Pringle a Cleghorn and a Monro and some others who have written since (the) last war but the name of Lind stands alone in the Navy. Amidst the few advantages his situation afforded him for study the spirit of observation never forsook him and his works comprehend the best study of climate that has yet been published.' Elsewhere Trotter speaks of him as 'the father of Nautical Medicine'.

Observations on the Scurvy. Introduction p. xxii. Second edition 1792. Medical Museum. 1797. vol. i. p. 10.

Clinical and Practical Notes.

AN OUTBREAK OF ENTERIC DUE TO OYSTERS

By Fleet Surgeon H W B Shewell M A M B L S
Surgeon C Dyvrel Marshall R N S A L S A I

The fact that oysters may be contaminated with sewage and known and recognized, and so many attacks of enteric fever traced to this cause that no proof of this method of the disease is required As a somewhat serious outbreak recently occurred in H M S Eurydice it has been thought to publish the facts so that in future such precautions as should be taken to avoid similar outbreaks

On October 5 1911, the ship being in Portsmouth Harbour of oysters was ordered to be delivered from a well known monger Thirty dozen were purchased and during the day were opened ashore and brought off They were served the Ward Room at 7 30 p m—when most of the officers and servants partook of them At the time nothing unusual anyone who ate them and there was nothing to cause condition The next day the ship proceeded to sea

Within forty eight hours of eating the oysters several attacked with severe gastro enteritis There was violent vomiting, and their condition was such that it must be taken off duty and put on the sick list Several more among the ward room servants, and within the next appeared After rest in bed on slop diet and the symptoms subsided but in many cases recurrence of took place as soon as the patients resumed their On careful inquiry it was found that not a single person from eating the oysters was affected and two only escaped thirty who had taken them It was fully three and a half all the patients were well, and during that time several days on the sick list

On October 28 one of the officers Lieutenant affected showed symptoms of fever and general malaise temperature ranging from 102° to 101° The following day the diagnosis of enteric fever was made midshipman and a marine sergeant also complaining symptoms In each case enteric fever was diagnosed it was decided to land the three cases and they were taken ashore and placed in the Royal Naval Hospital in each case the diagnosis was confirmed The ship proceeded

On Friday, November 6 (seven days after the first a marine officer was taken ill with similar symptoms Although his symptoms differed somewhat from the other cases he was treated for enteric The next day he was worse and complained a good deal of pain over the hepatic region and at times became

[illegible] On November 8 arrangements were made [illegible] taken up to the Royal Naval Hospital Stonehouse [illegible]

[illegible] showed typical signs of the disease within eighteen [illegible] the oysters but the fourth case did not complain of [illegible] days after having done so they had however, [illegible] gastro enteritis previously.

[illegible] the usual course of enteric. The midshipman [illegible] though seriously ill never gave rise to any undue [illegible] had a most severe attack, and several times he [illegible] collapse (five to six weeks after he had [illegible] life was despaired of, and he was thought [illegible] occasion. However he got better, and [illegible] considered to be out of danger.

[illegible] from the others. The incubation [illegible] above. The temperature was more [illegible] the others. A day or two after he [illegible] abdominal muscles, jaundice and tenderness [illegible] He certainly had cholecystitis. The [illegible] though positive in the others [illegible] which was then diagnosed [illegible] and after about five weeks in [illegible]

[illegible] lieutenant had a bad attack of [illegible] midshipman had a similar attack two [illegible] severely from gastro enteritis [illegible] they had eaten the oysters [illegible] that the oysters were the cause of [illegible] probable that such was the case.

[illegible] that the oysters were the cause of the [illegible] to the Medical Officer of Health Portsmouth [illegible] investigated the question. He very kindly [illegible] gave us the following information: —

[illegible] had been dredged from Langstone Harbour [illegible] infection as several outbreaks of enteric [illegible] to oysters taken from its various creeks [illegible] that all oysters taken from the [illegible] uncontaminated water for three weeks [illegible] In this case there is evidence that [illegible] Oysters from the same source were [illegible] examination. Professor Klein carried [illegible] infected with *Bacillus typhosus* [illegible] definitely proving contamination [illegible] Langstone. [illegible] from oysters [illegible] from being brought to [illegible] there is no law to prevent them [illegible]

[illegible] and it assumes still [illegible] Portsmouth ships are constantly [illegible] there is no guarantee that [illegible] the greater part of a [illegible] the large number of officers on

the sink [illegible] the work of the ship [illegible] and with [illegible] and had the ship been called upon [illegible] have been [illegible]one

If as appears to be the case [illegible] things as stringent [illegible] instructions should be sent to [illegible] of the danger and forbidden [illegible] as an article of food

— —

A POSSIBLE CASE OF TYPHOID INOCULATION FEVER

By S[illegible] [illegible] [illegible]

[illegible]

An interesting case [illegible] recently occurred [illegible] in which the symptoms [illegible] occurred. The [illegible] which [illegible] Widal reaction [illegible] after the [illegible]

H[illegible] JOURNAL [illegible] 1911 with the following [illegible] —

He received [illegible] on November 6th [illegible] several days afterwards [illegible] slight [illegible]

On November 15th [illegible] sick with fever, headache and [illegible] disappeared the next day [illegible] The [illegible] gradually became worse and on November [illegible] developed the temperature rising to [illegible] reached [illegible] and remained there until three [illegible] normal until [illegible] to hospital

On admission on November 20 the symptoms and [illegible] were such as one would expect to [illegible] of typhoid fever. The tongue was thickly furred [illegible] edges. The abdomen [illegible] on palpation. The spleen was not palpable but the [illegible] extended two fingers breadth below the costal [illegible] of congestion were present at the base of the right lung [illegible] case in enteric fever. But they did not appear to be [illegible] for the appearance of the patient the severity of [illegible] this pyrexia

On December 3 the stools, which had previously been [illegible] coloured, became liquid and tinged with blood but on [illegible] the symptoms improved and the temperature fell to normal [illegible] the fall of temperature being by lysis.

A Widal reaction performed on December [illegible] result. In an article entitled "The War and Typhoid Fever" (*[illegible] Journal*

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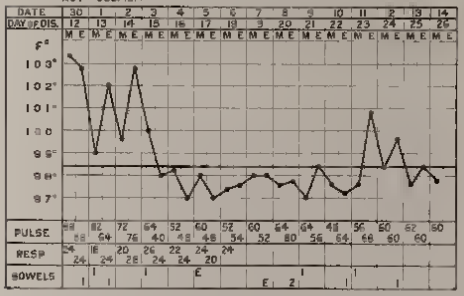
[1] Note.—Details of these cases were reported to the Medical Department of the Admiralty in a letter [illegible] this subject. [illegible]

November [illegible] Sir William Osler states that symptoms suggestive of enteric [illegible] itself may follow inoculation He quotes two cases [illegible] the injection was followed by an 'illness not to be distinguished [illegible] typhoid fever' and which was considered to be a typical typhoid [illegible] typical as such

In the *British Medical Journal* of January 9, 1915, an interesting case of enteric fever [illegible] by autopsy is reported by Major E A Bourke R A M C and Dr Sidney Rowland In this case the patient had received two inoculations the first in March 1914 and the second a few days before the onset of his fatal illness The well known symptoms of enteric fever were absent and the diagnosis was only established in the fourth week of the illness when the urine was found to be 'full of typhoid bacilli in agglutinated clumps



The authors attribute the absence of the usual symptoms of enteric fever to the masking effect of the protective inoculations The result of the Widal reaction is not stated but a positive reaction would probably have resulted from the injection in March and would not have been of any diagnostic value

In view of the unfortunate and dangerous prejudice that exists in the popular mind against anti typhoid inoculation, we should be very cautious in attributing to the inoculation any illness which may happen to follow this therapeutic measure.

As Fleet Surgeon P W Bassett Smith C B, says in his paper, on 'Typhoid and its Prevention' in the JOURNAL OF THE ROYAL NAVAL MEDICAL SERVICE (January 1915) such cases 'in the popular mind are certain to be put down to the inoculation and are distinctly unfortunate' especially as these anti typhoid vaccines have been used as a therapeutic agent with marked benefit

[illegible] to which Sir William Gull [illegible] W[illegible] on this case was negative. A [illegible] on five to ten days after the [illegible] result has persisted after [illegible] thus Maverick quoted by [illegible] W. Goodhart [illegible] cites the case of a youth aged [illegible] who [illegible] occasions in eight months with diffi[illegible] [illegible] serum never showed the presence [illegible] of his brother's positive re[illegible] with one of the strains used upon [illegible] in this connection that a negative W[illegible] [illegible] percentage [illegible] [illegible] other fair

[illegible] the simple is made in serie[illegible] too [illegible] [illegible] mention [illegible] the [illegible] [illegible] [illegible]

somewhat sluggish To prevent [illegible] advanced symptoms he was sent to the Government Civil Hospital at Suez on arrival at that place

On December 7 two days after the above man reported himself, two other cases came to the sick bay also complaining of swelling of both legs Beriberi was then suspected and an examination of the ship's [illegible] was made Seven cases besides these three were found to have oedema of both legs some in a fairly marked degree and some very slight Both these two cases which reported themselves on December 5 were placed on the sick list but the seven cases found on examination were given light duty as no other symptoms beyond the oedema of both legs developed

This now made three cases in all on the sick list and seven cases on light duty One of the cases of December 5, a boy aged 17 developed alarming symptoms and in four days had complete loss of knee jerks, marked tenderness of the calf muscles anaesthesia over the soles of the feet, anterior borders of the tibiæ inner sides of both thighs finger tips and over the thenar area of both hands He was only able to pick up a pin with great difficulty The heart was dilated and the first sound at the apex blurred He was able to stand up, but could hardly walk His gait was typical of peripheral neuritis On arrival at Aden he was sent to the European General Hospital

The other case of December 5 improved considerably the oedema disappearing and as no further symptoms developed he was discharged to duty after being on the sick list for five days

On investigating the reason of the outbreak no definite cause could be ascertained beyond perhaps the lack of fresh vegetables for some considerable time and mouldiness of the flour

I could attach no importance to rice as these men very seldom eat it Moreover it is cooked once and is practically the only food eaten by the natives every day All these ten cases came from the same mess (i e, the seamen's mess) the petty officers chief petty officers and all other messes remaining exempt As far as could be ascertained this seamen's mess did not eat of food other than that supplied to the whole of the European ship's company

On going into each article of food in detail the flour was found to be mouldy and musty and had a yellow hue The men stated the bread was very mouldy and they were hardly able to eat it

Detailed microscopical examination showed that there were some rice grains mixed with the wheat and also the following parasitic and fungoid growths —

(*a*) Weevil (*Calandra granaria*)

(*b*) A large amount of *Cladosporium purpureum*

This last named fungus produces discoloured bread and furnishes the bread with a sour odour All this flour in time which were obtained at Bombay in August last was condemned and fresh flour in bags obtained

Regarding the position of the mess it is on the foremost troop deck This ship in peace time does a considerable amount of trooping so that this mess may be sometimes occupied by Europeans and sometimes by native soldiers but no lascars or native stokers of this ship have ever occupied the mess When the ship arrived at Suez fresh vegetables were issued every day as a ration and a considerable amount was taken on board as a stock while this ship was at sea. Lime juice was issued

[illegible] very day, and [illegible] to issue from [illegible] changes each [illegible]

The season [illegible] Others [illegible] thoroughly [illegible]

Inspection [illegible] time showed [illegible] in some cases [illegible] marine, who [illegible] symptoms [illegible] and he developed [illegible] of the [illegible] and there was [illegible] the cardiac symptoms [illegible] thought necessary to [illegible] of the ship [illegible] Civil Hospital [illegible] the same time [illegible] the latter [illegible] to improve [illegible]

This makes [illegible] seven cases still remaining in the ship. All [illegible] improved [illegible] to the improvement [illegible] of the Commander-in-Chief those cases [illegible] discharged [illegible] in the first opportunity.

It will be seen that only one case developed serious symptoms and well marked [illegible] with complete [illegible] the others showing [illegible] both legs and a tendency to [illegible] dilatation [illegible] there [illegible] murmur [illegible] Some complained [illegible] of the legs and [illegible] whereas others [illegible] Royal [illegible] Company stated that [illegible] of the legs before [illegible]

None of [illegible] had albumin in [illegible]

The outbreak [illegible] shown [illegible] signs [illegible] symptoms [illegible] This [illegible] the [illegible] for [illegible] symptoms to have [illegible] environment and to be [illegible] from the ship [illegible]

INTRACRANIAL DISEASE AND GLYCOSURIA, NOTES ON TWO CASES

By [illegible]
[illegible]

The following two cases [illegible] which occurred [illegible] the Royal Naval Hospital [illegible] during 191[illegible] appear to be of interest especially from a diagnostic point of view [illegible] glycosuria was a prominent feature.

The presence of sugar in the urine has been noted in cases of cerebrospinal fever, but is apparently uncommon. Dr. Ormerod in his article on "Epidemic Cerebrospinal Fever" in Sir Clifford Allbutt's "System of

Medical [illegible] that glycosuria has been rarely observed, while Osler ('Principles of Medicine') and Dr E W Goodall (*Med Chron* 1911) mention this symptom has been noted in some instances

Cases [illegible] occasional exceptions are recorded—one of cerebral, or rather of [illegible] hæmorrhage—authorities (Kerrier Osler Tooth), [illegible] the occurrence of glycosuria in destructive lesions of the brain [illegible] especially in [illegible] hæmorrhage and in lesions of the fourth ventricle [illegible] I have been unable to find any reference [illegible] to a case such as this in which intermeningeal bleeding Sir William Osler [illegible] that the abundant presence of albumin and sugar in the [illegible] cerebral apoplexy is an unfavourable symptom

[illegible] patient in health, a signalman aged 25 was admitted into hospital on March [illegible] having been suddenly taken ill on board his [illegible] three days previously, with vomiting [illegible] which he had eaten the night [illegible] after he came under observation on [illegible] by the temperature which had been at normal [illegible] becoming, in the words of the medical [illegible] and noisy and at times rather delirious

When [illegible] the patient was in a semi conscious condition [illegible] able to answer questions sensibly, and [illegible] but as soon as he was left he relapsed into a [illegible] The temperature on admission was [illegible] was of full volume and high tension frequency 102 [illegible] 36 The tongue was coated with a [illegible] physical signs could be elicited in the heart [illegible] viscera but loud tremulous sounds, with diminished [illegible] resonance were present over both lungs Examination of [illegible] threw no light on the diagnosis the pupils were [illegible] normally there was no strabismus or head retraction, and [illegible] were unaffected No rash was present on the skin

[illegible] decided to regard the case as one of pneumonia with secondary [illegible] of the meninges, although the absence of any of the characteristic [illegible] of the latter affection rendered the diagnosis obscure On [illegible] the urine was found to contain a large quantity of albumin [illegible] Tichlim's solution Johnson's test positive, and [illegible] the presence of which added a further element of doubt to the case Diabetes coma was suggested but this was negatived by the [illegible] reactions [illegible] acetic acid was present There was no [illegible]

The [illegible] continued [illegible] the next two days the respirations increased in frequency becoming deeper and almost stertorous in character and the patient became increasingly cyanosed and orthopnœic [illegible] signs of consolidation of the lower lobes of both lungs were [illegible] On the 26th phlebotomy of the left median basilic [illegible] performed with, however, but little effect either in quieting the [illegible] action, the respiratory embarrassment, and in spite of all [illegible] death occurred on the evening of March 27, two days [illegible] admission

A post mortem [illegible] performed the day after death the case was found to be one of cerebro spinal meningitis On opening the skull and removing

the dura mater the pia arachnoid [illegible] gested and the superficial veins [illegible] of the larger vessels were pa[illegible] which was more abundant on th[illegible] than on the [illegible] In view of the occurrence of the [illegible] the inflammatory changes were [illegible] medulla and lower part of the p[illegible] these parts and surrounding th[illegible] ventricles contained no pus or [illegible] much congested in appearance [illegible] pathological changes to the [illegible] were deeply engorged and [illegible] for the physical signs observed during [illegible] of the other thoracic or abdominal viscera was found

Stained smears of the meningeal exudate showed [illegible] not intracellular Culture on agar gave a growth of [illegible] diplococcus resembling the *Diplococcus intracellularis* [illegible] Surgeon G B Scott R N of the Royal Naval H[illegible] kindly confirmed the diagnosis by cultural methods [illegible] producing acid and gas in maltose and dextrose after [illegible]

The second patient a private of Marines aged [illegible] on the evening of April 7 with a history of having fallen down [illegible] on board H M S 'Thunderer' a few hours previously He was [illegible] diately seen by a medical officer who reported that he was [illegible] semi conscious condition but soon lapsed into unconscious [illegible] He vomited twice before becoming unconscious the vomited matter [illegible] ing of coffee The corneal reflex was absent the pupils [illegible] inactive and slightly unequal there was no strabismus The pulse was irregular slow and of poor volume and the respirations were short and laboured When admitted into hospital the patient was in a comatose state with contracted pupils stertorous breathing and full high tension pulse

These symptoms occurring in a young patient apparently in excellent health and with no history of antecedent syphilis or other serious disease suggested a diagnosis of cerebral hæmorrhage but the possibility of acute narcotic poisoning had to be considered A further difficulty however was introduced by the fact that on testing the urine which was drawn off by catheter it was found to contain abundance of glucose but in the first case no acetone bodies or albumin A diagnostic lumbar puncture was performed but although the needle undoubtedly entered the spinal theca the puncture was 'dry' no fluid being obtained

The stomach was washed out with a solution of permanganate of potassium and as the patient was becoming increasingly comatose and dyspnœic 30 oz of blood were withdrawn from the left median basilic vein At midnight the pulse suddenly became feeble bloodstained froth issued from the mouth and after a few spasmodic respiratory efforts the patient died

A post mortem examination was performed the following day in the immediate cause of death and also the explanation of the glycosuria were found in a large intracranial hæmorrhage at the base of the brain A large dark firm clot was found covering the base of the pons and medulla oblongata extending downwards into the spinal canal and

upwa[illegible] The effused blood occupied the [illegible] being apparently healthy The bled[illegible] The cerebral ventricles contained [illegible] No predisposing cause of the h[illegible] The kidneys were rather darker than usu[illegible] appearance. The heart was not hyper[illegible] atheromatous changes

[illegible] Diabetes was rendered more difficult th[illegible] of sugar in the urine Diabetic co[illegible] The influence of the ferric chloride reaction in the [illegible] absence of acetone bodies in the [illegible] the presence of [illegible] of secondary importance merely [illegible] presen[illegible] of the fourth ventricle

PENETRATING [illegible] WOUND OF THE THORAX AND ABDOMEN

(Wound of [illegible] Stomach, Liver and [illegible])

By [illegible] Surgeon [illegible] Royal Navy

[illegible]

Gun[illegible] aged [illegible] was admitted into the Royal Naval Hospital Plymouth on December [illegible] having accidentally shot On admission [illegible] an entrance wound of a bullet [illegible] in the [illegible] border of the fourth rib right side No hæmoptysis [illegible] Skiagraphic examination revealed the bullet [illegible]

One hour after [illegible] vomited a little blood and became rigid and tender in the [illegible]

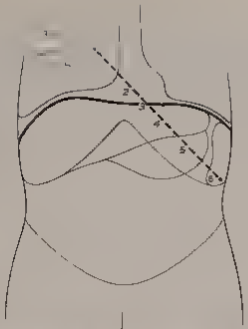
I opened the abdominal wall through the left rectus Two wounds in the stomach were [illegible] Blood welled up from the outer side of the abdominal [illegible] The left hypochondrium was found to contain some clots The [illegible] examined and found to be lacerated at the lower end with the bullet partially embedded in its parietal surface An incision was made outwards below the costal arch and the spleen exposed The [illegible] was closed Recital saline was given He seemed to progress without any complication until December 7 when he complained of pain in the precordial region a marked pleuritic friction was heard over the [illegible] and track of the bullet Pulse 120 to 130 respiration 32 to 40

December 8 Pneumonia and pleurisy marked Pulse 120 to 198 very irregular in every [illegible] The lungs freely no dulness found

December 10 Abdominal wound septic stitches had given way at the upper part

December 11 Abdominal wound more open with protrusion of [illegible] Pulse rapid and irregular and heart sounds not so distinct

December 20 A diffuse swelling at the right side of the neck, [illegible] triangle the hollow under clavicle obliterated Veins prominent lymphatic glands enlarged



December 30 Still [illegible] pictures [illegible] aleanor All the [illegible] about the [illegible] feat dulness to right [illegible] of the sterno [illegible] [illegible]

January 1 Pulse [illegible] to 140 respirations [illegible] to 40, abdomen [illegible] clean Very restless [illegible] continued in this condition until [illegible] when he died

Post mortem.—Bullet entered at the upper border of the [illegible] wounded slightly the right lung entered the pericardium [illegible] through the liver and stomach, and lodged in the spleen [illegible] pericarditis present and was the cause of his death The [illegible] stomach wounds had healed

Remarks

On admission the patient had no symptoms that called for operation One hour after entry the vomiting of a little blood and pain and rigidity in the epigastric region called for immediate surgical interference The bullet wounds of the stomach were quickly found The fact that the spleen was still bleeding necessitated its removal The bullet was found at the operation sewn embedded in the parietal surface of the spleen, vide fig 2 It would appear as if, after the bullet had wounded the lower end of the spleen it passed on and struck a rib which deflected it back again into the spleen

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A METHOD OF GROWING YEAST FOR MAKING BREAD

By Surgeon L. L. Atkinson, R.N.

The following account of a method of growing yeast for breadmaking may be useful in ships whose stock has run low or in any establishment where a fresh stock is not obtainable At present and for some time past no great reliance can be placed on the supplies of German yeasts which are sold commercially. They frequently produce a weak and ineffective yeast and often die out very quickly

The process depends upon the almost universal presence of yeasts in certain cereals In the British Antarctic Expedition of 1910 to 1913, a culture such as is described below was started, and it lasted with great success for over two years

The Medium.—

The following ingredients are mixed together and brought to the boil 1 lb. of malt 1 oz. of hops ½ lb. of bran ½ lb. of sugar 1 gallon of water

The whole is then allowed to simmer for half an hour The medium is next allowed to cool in any receptacle slowly until 104° F. is reached A large handful of bran a small handful of malt and a small handful of sugar is then added The whole is then placed in a warm place and allowed to grow Care must be taken not to allow the temperature to rise above 110° F. or to sink below blood heat At the end of twenty four hours the yeast will be sufficiently active to use for raising dough

It is a good plan to keep this original growth and to subculture for daily use with a similar medium The quantity necessary is about 1 pint of the old culture to a gallon of the medium The yeast to be

[illegible] first normally for about [illegible] can be carried on longer [illegible] and the can best be done by [illegible] melted [illegible] pint of potatoes (2 lb.) [illegible] chopped raisins 3 oz. of hops [illegible]

Boil [illegible] each 104° F. a subculture can be made [illegible] the original [illegible] four hours growth it is again subcultured to the original [illegible]

The [illegible] quality of German yeast has been marked. Where before [illegible] 6 oz. to raise 300 lb. of bread it now needs at least 10 oz. [illegible] then uneven and becomes sour.

The method [illegible] closely followed and was used in making the bread for over two [illegible] the Hut in the Antarctic. It has also been adopted for mid[illegible] bread in the 'St. Vincent' for several weeks now. A micro[illegible] examination will often give information as to the nature of the [illegible]

SPENGLER'S PIKRIN METHOD OF STAINING TUBERCLE BACILLI

[illegible] ROBERT M. RIGGALL, R.N. (Reserve)
[illegible] Assistant Physician to the Queen Alexandra Sanatorium
[illegible] Davos Platz, Switzerland

To the [illegible] of this method I am indebted to Dr. Hugh H. Carleton, Medical Superintendent of the Queen Alexandra Sanatorium, Davos Platz.

The [illegible] is undoubtedly more delicate than an ordinary Ziehl Neelsen, and frequently a sputum examined by it will be returned T.B. positive when it has been returned negative by the latter. This was found to be the case in a series of investigations carried out in the Queen Alexandra Sanatorium.

For diagnosis it is probably better to follow the Ziehl Neelsen routine first, and if the results should prove to be negative to use the Pikrin method in preference to antiformin.

The routine is as follows:—

(1) Make films of sputum.

(2) Dry with gentle heat over flame.

(3) Stain in the usual way with carbol fuchsin, taking care not to overheat.

(4) Stain with Pikrin solution, renewing the solution several times until the red becomes yellowish.

Pikrin solution	Esbach's solution	Half
	Absolute alcohol	Half
Esbach's solution	Picric acid	10
	Citric acid	20
	Water	1,000

(5) Decolorize with nitric acid 15 per cent. for one minute.

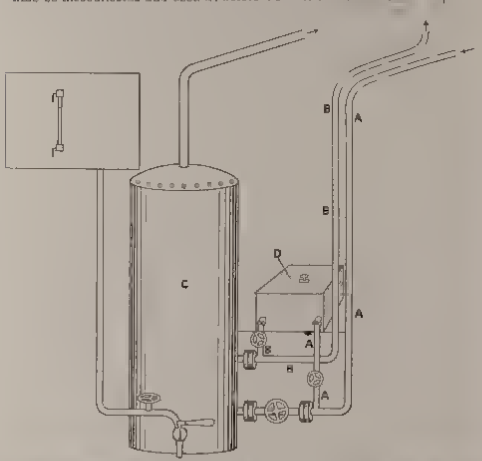
(6) Counterstain with Pikrin solution.

(7) Wash with water very quickly and dry on blotting paper at once.

ADAPTATION OF STERILIZER FOR USE WITH STEAM GEYSER

By Fleet Surgeon ADRIAN A. FORRISTELL, M.D., U.S.N.

The instrument sterilizer supplied is heated by means of a petroleum lamp [illegible] I do not think is desirable in a first-aid [illegible]. It occurred to me that could the sterilizer be heated by [illegible] it would have many advantages. I planned the arrangement shown in the drawings which acts in a most satisfactory manner. The design was carried out by the engineering department of the ship. The steam can at any time be disconnected and used as before to be heated by [illegible]



[illegible] B exhaust steam C steam geyser D sterilizer [illegible] [illegible] manner in the ordinary manner as designed [illegible] [illegible] as the instrument.

Description of Method of Converting

Half inch copper piping (tinned) is led as a double coil round the [illegible] of the sterilizer in the space between the side and the wire basket in which the instruments are placed. The ends of the piping

are brought out through one end [illegible] and bushed with [illegible] slipped joints. These joints [illegible] the steam supply [illegible] geyser the other to the exhaust [illegible] ½ in. barrel [illegible] Steam cocks are fitted to each [illegible] steam turned on or off as required. The steriliser is [illegible] by means of a bracket. It is filled with water in the ordinary way, [illegible] turned on and it boils in from three to four minutes.

[illegible]

The advantages are:

(1) No danger from fire as with [illegible] lessening installation in action.

(2) Boils in three or four [illegible] times faster than other [illegible]

(3) It can be boiled at the [illegible]

(4) It can be boiled apart from [illegible]

(5) It can be disconnected [illegible] and used [illegible] by lamp).

(6) It is absolutely under control and there [illegible] blowing up.

(7) There is nothing to get out of order as in [illegible]

(8) Steam will probably be available in action [illegible] circuits have gone out of gear.

(9) By superimposing the dressing containers [illegible] sterilized.

A SCUTTLE VENTILATOR

By Lieut.-Surgeon MUNRO, R.N.

Since the beginning of the war all ships employed in the North Sea have been darkened at night. In Northern latitudes in the winter this means eighteen hours out of twenty-four.

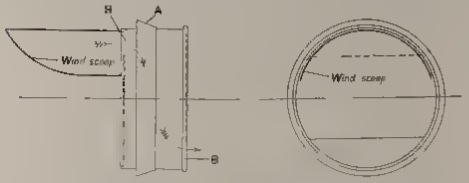
In many of the older ships of the Royal Navy [illegible] nearly all the small ships, such as destroyers, [illegible] ventilation on the main deck and they are dependent [illegible] ventilation through scuttles and deadlights.

When ships are darkened hatches must be [illegible] scuttles and deadlights screwed down, all [illegible] ventilation is cut off.

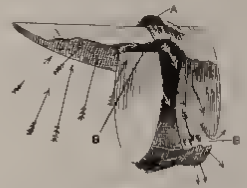
The condition of affairs is for [illegible] detrimental to the health of those living in these confined [illegible] adds much to their discomfort. Any means [illegible] ventilation can be improved should be of much [illegible]

large number of ships of the mercantile marine more especially to those responsible for the general health

In this ship the Blake various devices have been tried and experimented with to obtain air and at the same time to prevent any light showing In harbour on main decks, there is no reason why they should not be used though possibly at sea there are reasons why scuttles and deadlights should be kept closed



Scuttle ventilator with wind scoop addition



Scuttle ventilator [illegible] part removed

Of all the devices that I have seen the one I now wish to bring to notice is the simplest and most efficacious It has been designed and patented by Lieutenant Commander Ronald G Morton and the [illegible] of this ship It is in use to a limited extent both here and in the destroyers but owing to the pressure of work it has not been possible to turn out any quantity Having one in use in my own cabin I can testify to its thorough efficiency and to the fact that it quite prevents any light showing outside the ship It is in fact more efficient in this respect than a carelessly screwed up deadlight

Description of Ventilator

The ventilator consists of a drum made of tin which is made to accurately fit the porthole A small inclined flange (A) fitted round the

outside of the [illegible] bears against the scuttle flange to prevent any light escaping due to [illegible] encounter of the fit of the drum in the portholo This flange also prevents the ventilator slipping through

Each diaphragm has a segment (B) cut away to such a position that it is diametrically opposite to its fellow the height of the segment should be about one eighth of the diameter of the drum

For a full sized scuttle the depth of the drum, as at present made, is 6 in and the depth of the flange is 2 in the latter being fixed at an angle of about 45 degrees

The whole ventilator should be painted dull black and this is important A small clip can be fitted to scuttle screw to keep ventilator in place, if necessary

A wind scoop can be fitted to the outside of the drum but except in hot climates or perhaps in destroyers, this is probably not necessary Possibly the ordinary wind scoop provided by the Admiralty for ships in hot climates could be adapted for the purpose by the addition of the diaphragm cut in the manner described and fitted with a flange

In peace time the ventilator would be of use in regulating the air supply in cabins where the scuttle cannot be opened without causing a draught on the person sleeping in the bunk beneath and would possibly allow ventilation at sea by keeping out spray, which would otherwise necessitate the closing of the scuttle

The ventilator is simple in design and would be cheap to make and should be of some use in almost every class of ship The use of these ventilators also tends to obviate the excessive sweating of the bulkheads which is so prevalent and difficult to prevent

Reviews.

ANNUAL REPORT OF THE SURGEON GENERAL UNITED STATES NAVY (FOR THE FISCAL YEAR 1914)

This Report which deals with statistics of health for the calendar year 1913, shows a steady general improvement in the health of the United States Navy in recent years and a remarkable decrease in sickness from typhoid fever which is alluded to in more detail below

Diseases of Special Interest

Malaria.—The incidence of this disease increased from 11·63 per 1,000 in 1912 to 12·07 in 1913 This increase is accounted for by the cases occurring in ships in Mexican waters The value of screening was well demonstrated, those ships which were well screened escaping the disease or having only a few cases while unscreened ships under the same conditions had a large number of cases

Smallpox.—An outbreak in the 'Ohio' during December 1913 shows the protection derived from general vaccination. There were 90 cases with 5 deaths in this ship

The 'Ohio' and the 'Vermont' visited Marseilles and remained there for about a month, during which time leave was freely granted

Small pox of the [illegible] type was known to be present in Marseilles. The crew of the "Vermont" had been vaccinated before leaving for European waters—no small-pox appeared in that ship, though the men were exposed in the same manner as those of the "Ohio."

There was no record of any vaccination having been done in the "Ohio" for two years before the outbreak and vaccination of the crew immediately gave 89.57 per cent. of "takes." A draft of 100 recruits was received in the "Ohio" shortly before sailing for Europe but those men had been freshly vaccinated and no small pox appeared amongst them.

Typhoid Fever.—In view of the fact that anti-typhoid inoculation was made compulsory early in 1912 in the United States Navy for all officers and men under 40 years of age, the records of the Surgeon General have particular interest.

The incidence of typhoid fever for the past five years is shown by the following table:—

Year	Admitted		Died	Sick days
	Number	Rate per 1000		
1909	194	3.49	17	10 378
1910	103	1.80	10	9 396
1911	392	6.61	15	14 024
1912	57	0.92	2	5 234
1913	42	0.83	4	1 607

The remarkable decreases in 1912 and 1913 will be noted. It is probable that the full effect of general inoculation would not be apparent until 1913. It is remarked that no one knows how long the immunity produced by the prophylactic will last, but that the advice and work of the United States Navy specialists in connection with those of the Army and Public Health Service, it is hoped, will give this information before the immunity is lost.

Sanitary Conditions and Measures Afloat.

In this section of the report are several interesting observations particularly in regard to toilet equipment, first aid instruction and engine room conditions.

The type of toilet equipment (i.e. w.c.) has been found faulty and it is believed a more satisfactory type could be obtained. Future ships will have it's [illegible] adjacent to isolation wards but use only by the occupants of such wards, thus the danger of spreading contagion by close stools which often have to be carried for a long distance before they can be emptied will be largely nullified.

First Aid Instruction is given to the personnel of the United States Navy by the division officers. After two years of observation, it is still a question if it would not better to return to the former system of giving first aid instruction by the medical officers and hospital corps men. The Surgeon General recommends that a committee be appointed to consider this subject.

The experiment of closing in the engine room hatches of some ships and providing powerful exhaust blowers at the top of the engine room with powerful supply blowers at the bottom has proved a great success. The engine room conditions in such ships being ideal: the temperature seldom goes above 90° F. in moderate climates and often lower. It is stated

[illegible] mo[illegible]
important [illegible] ld be
undesirable [illegible]

THE PRACTITI[illegible]
by J Keogh [illegible]
Press H [illegible]

The value of [illegible] and for [illegible]
within a year [illegible] fore the [illegible]
important disc[illegible] rather [illegible]
hetical his[illegible] well kno[illegible]
and thoughtf[illegible] information [illegible]
brought up to [illegible] ined one [illegible]
into constitutional [illegible] neurotic [illegible]
zgeotic infections [illegible] the diseases [illegible]
various systems [illegible] or diseases of childr[illegible]
Life insurance clinical pathology, medico legal points, and mental d[illegible]
orders follow Surgical conditions and anæsthetics take up the ne[illegible]
300 pages obstetrics and gynæcology another 200, and from those w[illegible]
pass to the diseases of special regions eye ear throat and skin, the l[illegible]
100 pages being devoted to special forms of treatment

The whole is a very useful work to have handy for those who are [illegible]
general practice either on shore or afloat It is in clear print on good
paper and the illustrations inserted are useful F W B S

AN OPERATING THEATRE IN PRIVATE PRACTICE By G Hamilton
Whiteford M B C S L R C P London Harrison and Sons
Pp 76 With illustrated supplement Price 3s 6d net

In this little book the author describes a small operating theatre built in 1911 to his designs at a nursing home In the preface he emphasizes the great disadvantages from the view of surgical cleanliness of operating in the bedroom of a nursing home or in the bedroom of a private house His aim was to evolve a building in which strict asepsis could be observed with a minimum of labour for all concerned, appearances being made subservient to utility and ease of working

The opening pages give a general outline as to the floors windows doors water supply, lighting heating, bells and sterilizers The heating of the anæsthetizing room and the theatre is by electricity the heaters being let into the surface of the wall 6 in above the floor level The surface of each heater is enamelled, and is flush with the wall There are four in the theatre and two in the anæsthetizing room one in either wall and each is actuated by a separate switch It is remarked that such electric heaters constitute a great improvement on those worked by water steam or gas and that the cost of running is not excessive

Full descriptions follow of the anæsthetizing room dressing room sterilizing room, and theatre, the equipment of each being dealt with Contrary to the opinion held by some surgeons the author finds a temperature in the operating theatre of 60° to 65° F to be amply sufficient always provided the patient be on a warm table with his limbs warmly clothed and all unnecessary exposure avoided The operation table is also heated by electricity a removable metal box being fixed

[illegible] the [illegible] Hut [illegible]
[illegible] Other Theatres

[illegible] illustrations of the theatre and sterilizing [illegible] the general equipment during 1913 are given [illegible]

[illegible] durable and interesting devices are described [illegible] inventive genius of the author liable as Naval Medical Officer [illegible] called upon at short notice to design and equip a small operating [illegible] the book should prove of great interest to them, and can be strongly recommended W L M

The Extra Pharmacopœia Martindale and Westcott Sixteenth edition Revised by W Harrison Martindale, Ph D, F C S, and W Wynn Westcott M B Lond, D P H London H K Lewis, 136 Gower Street W C 1915 Vol I, pp xl + 1,113 price 14s net Vol II pp viii + 469, price 7s net

The popularity of this work is demonstrated by the fact that it has attained its sixteenth edition As in the last edition the book is divided into two volumes The first describes the properties manufacture administration and uses of those "Extra pharmacopœial chemicals and drugs which have attracted particular attention in the medical world This volume also deals with vaccines organo therapy and the sale of poisons It contains a list of the most potent antiseptics, based on wide researches, and concludes with a general posological index referring to both volumes and an extended therapeutic index of diseases and symptoms Volume I includes everything any one is likely to require for immediate reference on therapeutic matters whilst the second volume sets as a supplement for further study since many articles which would not necessarily be required on the spur of the moment have been transferred from the former to the latter and thus the comprehensiveness of the first volume has been enhanced by lending it space for current expressions of opinion and the trend of therapeutics

The changes in the new British Pharmacopœia of 1914 are marked by the inclusion of twenty new drugs of which adrenalini liquor hydrochloricus vesonal ores-ol hexamina (urotropine) injectio strychninæ hypodermica liquor formaldehydi methyl salicylas, methylsulphonal, and terebenum are probably the most important, and the exclusion of fifteen old preparations of which papaveris capsulæ, sarsæ radix, stramonii semina and vinci sulphocarbolas were the most familiar

With regard to patent medicines, as the current war will naturally place Teutonic preparations in disfavour, probably for generations the authorities have provided the numbers of whose patents for which licences have been granted to British manufacturers

The various methods of producing anæsthesia, both local and general, are fully discussed under the headings of the respective drugs employed the article on stovaine is to be particularly commended

The chapter on Organic Arsenic Compounds has been revised, the new injection and methods of use of arsenobenzol being amply expounded

The chapter on Mercury contains much additional information e g the large doses of calomel used in the treatment of dysenteric diarrhœa and the experiments conducted with several entirely new organo mercury compounds

Under Specific Fevers a full account is given of [illegible] dysentery and liver abscess by relatively [illegible] emetine which have also been used with [illegible] haemoptysis

The reader will find in the chapter on Nutrition a [illegible] of extremely useful information on the various [illegible] milk preparations for the sick; the feeding of infants is [illegible] timely discussed and references are given to current literature [illegible] cussion of boiled *versus* unboiled milk Reduced pyrimidine [illegible] nistration as an intestinal lubricant receives adequate attention

In the section on Radiology a new Tungsten X-ray [illegible] with and the treatment of ringworm by epilation [illegible] tonsils is well described

The chapter on Radium has been thoroughly revised in the light of the latest research The account of the therapeutic use of the metal is enhanced by many important communications

With regard to vaccine therapy the authors hold that results undoubtedly justify the claims put forward on its behalf and the sections on asthma bronchitis, pulmonary catarrh diphtheria gonorrhœa, acne and rheumatism contain much new matter in support of their contention The articles on tuberculin treatment also sheds new light in the subject This work shows too that in the field of organic therapy there has been much activity

The therapeutic index of diseases and symptoms at the end of Volume I constitutes a valuable guide to reference in emergencies There is, no doubt, that both volumes should find a place in every medical man's library R C M

AN INDEX OF FIRST AID By J M Carvell M R C S I S A London John Bale Sons and Danielsson Ltd 1915 Pp 132 12 illustrations Price 1s net

This little work should be of great service to those who are or who are likely to be frequently called upon to render first aid It can be conveniently carried in the coat pocket and in an emergency the required information as to how to deal with a particular injury or illness can be obtained in the shortest possible space of time as every conceivable point is indexed alphabetically and in many cases with cross references

The author invites suggestions for improvement We think that a larger number of illustrations would be of great assistance to most first aiders R C M

A TEXTBOOK OF RADIOLOGY By Edward Reginald Morton M D C M Trin Tor F R C S Edin &c Past President Section of Electrotherapeutics, Royal Society of Medicine in charge of the X-ray Department West London Hospital &c London Henry Kimpton 1916 Pp 221 With 26 plates and 72 illustrations Price 7s 6d net

The aim of the author of this book is that it should form a useful guide to those taking up Radiology for the first time, and in this he succeeds admirably The chapter on Electrical Principles is written in a clear straightforward fashion—no attempt being made to go too deeply

[illegible] tion is given to [illegible] production of the [illegible] cussion [illegible] cal The author [illegible] dy of the X ray tube [illegible] ramble [illegible] rologist's equipment so [illegible] that a careful [illegible] rection will well repay the [illegible] description [illegible] tube, though at present [illegible] use to the naval [illegible] others is interesting as [illegible] lines on which the X ray tube of the future may be [illegible] more efficient [illegible] terpretation of negatives [illegible] to the few elementary remarks suitable to the scope [illegible] hunter—it being well known that only by examining [illegible] plates [illegible] every detail [illegible] ultimate interpretation become [illegible]

The [illegible] Surgical Radiographs will be of great use to the [illegible] he does not know how to obtain the best results in [illegible] the body Further by establishing and following out [illegible] rule of working the results become uniform and so [illegible] the normal appearance can be more readily detected The [illegible] Internal Disorders will be useful to those who have a more [illegible] knowledge of the subject Until he has obtained a complete [illegible] of his apparatus and especially of his X ray tube it is [illegible] for the beginner not to attempt these more difficult investigations

The [illegible] well illustrated and the plates are clear and well chosen [illegible] with advantage on the book shelf of every naval [illegible]

A K S S

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Abstracts and Translations.

[illegible] (C M) A New Method of Examining Stools for [illegible] *United States Naval Med Bull* January 1915 vol ix No 1

The author describes a useful method for detecting the ova of [illegible] parasites in the stools of suspected cases It is very simple [illegible] carefully carried out, effective since it depends on the [illegible] the ovum itself passively takes no stain, whereas most [illegible] material becomes deeply pigmented

The [illegible] technique is recommended —

[illegible] of fecal matter are thoroughly mixed with 5 c c [illegible] watery solution of lysol (or water only may be used)

The [illegible] is then centrifuged and the supernatant fluid decanted off, the [illegible] repeated two or three times

A [illegible] of the sediment is placed on a clean slide and a small [illegible] mixed with it A cover glass is then placed [illegible] and the preparation examined first with a ⅔ then a ⅙ objective

P W B S

[illegible] C S The Application of Wassermann's Reaction to the Solution of the Etiology of Tropical Ulceration *United States Naval Med Bull* January 1915 vol ix No 1

In this [illegible] interesting and instructive paper the author draws [illegible] to the great importance of utilizing the Wassermann reaction

for determining [illegible] lesions of the [illegible] and external ulcerations [illegible] As he states so frequently there is in these [illegible] that of an underlying disease with a local infection [illegible] to the extensive destruction of the tissues The [illegible] destructive diseases are leprosy tuberculosis and [illegible] the Tropics yaws or the tuni brothe of syphilis From his [illegible] experience and those of others in the Philippines and [illegible] America, he believes that syphilis is rampant in these areas and is the main cause of most of the severe lesions in leprosy certain [illegible] ulcus, tropical phagedenic and gangosa He quotes the [illegible] and others to show that histologically there are no characters in the diseases that can distinguish them from syphilis For the Wassermann test he has used Noguchi's and Lange's methods, but prefers the latter In examination of 200 lepers he obtained 44 5 per cent positive Wassermann reactions and in 375 natives suspected of syphilis it was 48 per cent of tubercular prisoners in the Philippines there was a percentage of 21 6 positives giving 41 per cent positive reactions of all the natives examined In Guam all types of syphilis were seen in the living yet post mortems disclosed very little visceral evidence of syphilis also that primary chancres are rarely seen The latter fact is probably due to the habits of the natives who would take no notice of a sore which gave rise to little discomfort hence the frequency of tertiary manifestations among them The article of R H Major in the *Johns Hopkins Hospital Med Bull* is quoted in which he tested 1,200 general cases 20 per cent gave positive reactions and of these nearly one-fourth gave no history of a primary sore In a comparison of whites and natives, the negroes showed twice as many positive reactions as the whites indicating the greater frequency of syphilis among the coloured races The author discusses gangosa very fully and he considers that this disease is but a manifestation of syphilis, in contradistinction to the opinion held by many well known tropical authorities, including Balfour At the end of the paper he summarizes his conclusions thus —

(1) Syphilis and frambœsia constitute a serious problem to public health in the Tropics and are the chief causes of mutilating ulcerations in Guam and the Philippines

(2) The Wassermann reaction is of incomparable importance in tropical medicine

(3) Gangosa in Guam and the Philippines comes in the class of complement absorbing diseases, and is on this basis comparable to tabes dorsalis and general paralysis The illustrations are excellent, and give a very vivid view of the conditions frequently found

(It is however important to note that leprosy frambœsia, and most spirochætic inherited diseases have long been known to give rise to a positive Wassermann reaction, which is a prompt reaction It is therefore rather too sweeping to class all cases where a positive reaction is obtained as syphilis) P W B S

McCutcheon (I I) Surgeon U S Navy The Best Training for the Hospital Corps for the Fleet *The Military Surgeon*, vol xxxi No 1 January 1915

The Training School for the Hospital Corps of the Navy was established during 1911 at the Naval Training Station Newport, R I

[illegible]e and primary object being to e[illegible]l for a [illegible] At the Newport Naval Training Station [illegible] to be found all the vocational schools of the Navy and the spirit of [illegible]n and friendly rivalry which would [illegible]e elsewhere

The completion of a new naval hospital at Newport [illegible]ch the old hospital eventually for the Training School for the Hospital Corps The [illegible]s were readily converted into laboratories and class rooms to [illegible]e for a class of 100 students or twice that number by dividing the class into two groups The recruit is housed [illegible] quarters which closely approximate those aboard ship as long as he remains in the station

The school has all necessary equipment for teaching the subjects its curriculum includes, which are as follows Anatomy and Physiology First Aid and Emergency Surgery Hygiene and Sanitation Clerical Duties Pharmacy Chemistry Materia Medica and the Action of Drugs Toxicology Foods and Cooking Litter and Stretcher Drill Tent Erection including the field hospital camps and camp hygiene lines with expeditionary forces embalming and disposition of the dead)

The course comprises six months Two subjects to which particular attention is given, are practical pharmacy and materia medica as neither hospitals nor battleships are adequately equipped for the instruction in these subjects to be continued

For each twenty five students, one hospital steward is required as demonstrator and a pharmacist gives the morning instruction in pharmacy chemistry and clerical work One medical officer's entire time is required for lecturing and administrative purposes

When service conditions permit the graduates are first transferred to hospitals for duty where they receive further instruction and acquire further experience in practical nursing the operating room, and all hospital duties It is not contemplated that instruction should cease on graduation from the school but will continue until the apprentice has reached the grade of hospital steward the grade can be reached in the minimum time of three years It is believed that the Training School for the Hospital Corps of the Navy, together with that instruction given by medical officers and senior members of the hospital corps at naval hospitals and in ships will provide the best training, and that this Corps for many years noted for its efficiency will maintain its high place among the naval services of the world W L M

[illegible]rton (N J), Medical Inspector U S Navy The Advisability and Practicability of Specialists in the Medical Corps of the Navy, *U S Naval Med Surgeon* vol xxxvi, No 2, February, 1915

The author is decidedly adverse to the appointment of specialists except the officers of the Medical Corps in general, but he believes that all hospitals and hospital ships should have the services of specialists as consultants specialists being members of the Medical Reserve Corps that each hospital should have a bacteriologist and a trained roentgenologist just as all hospitals have These men should be trained in their specialties and paid accordingly but should not be in the Medical Corps or required to do any other duties

It is the author's opinion gained after an experience of twenty years service in the Navy, serving through all the grades and duties from

[illegible] prior assignment to command of a hospital, this [illegible] naval medical officer is a specialist of the highest sense of the word. I think too much cannot be already expected of [illegible] and that in introducing [illegible] specialty and specialties each in itself a life work and study [illegible] only [illegible] and absolutely imprescindible in the interests of an efficient and homogeneous corps.

W. J. M.

Francis (Edward) Surgeon U. S. Public Health Service. A Recommended Method of Embalming on Shipboard. *The Military Surgeon*, vol. xxxvi, No. 2, February, 1915.

The great importance of ensuring a uniform distribution of the preservative in the correct amounts throughout the body is emphasized. In order to get a uniform distribution of fluid it is usually necessary to make six injections, one into each brachial artery toward the extremities and one each femoral artery toward the extremities into one common carotid [illegible] toward the head and into the same carotid toward the heart. In each instance when injecting the brachial, femoral or carotid arteries upwards the fluid is immediately seen returning through the veins and in this way the operator can rest assured that the fluid bathes all the tissues of the extremities or head.

The technique of injection is a matter of the greatest importance. A single injection into but one artery does not produce the widest possible distribution of the fluid, though the author does not deny that in corpulent cadavers holes are injected constantly through a single incision with a small amount of fluid and are preserved for two or three days until [illegible] however, is to withdraw [illegible] the high temperature of the [illegible] as [illegible] definite preservation will depend on its complete sterilization.

A [illegible] embalming fluid used at the Hygienic Laboratory of the Public Health Service has proved effective in preserving human subjects exposed [illegible] and to a temperature of 98° F. The formula of this fluid is as follows:

Formalin (40 per cent formaldehyde)	1 quart
Boric acid [illegible] Na$_2$B$_4$O$_7$)	60 gm.
Water sufficient to make	1000 c.c.

Note.—Strength of the formaldehyde (40 per cent) must be [illegible] for [illegible] solution of 3¾ per cent strength.

An objection to formalin is that it bleaches muscle but tissue to an ashy gray. This is overcome by adding an alkali to the formaldehyde solution, thus changing its reaction from acid to alkaline. The combination of alkali and formaldehyde intensifies the color of the [illegible] and produces the desired stability with only the slightest deterioration of the formaldehyde. Borax, being readily obtainable, is used in the [illegible] advantage of being itself a preservative.

The injection apparatus consists of a five-gallon bottle fitted [illegible] rubber stopper of which pass two glass tubes, one [illegible] the bottom of the bottle and affords an outlet for the fluid, which is [illegible] by a rubber tube to the glass cannula; the other tube is [illegible] by rubber tubing to a pump. A bicycle foot pump is very effective.

[illegible] injects [illegible]

[illegible]		[illegible]
[illegible]		1
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]

It is not [illegible] to the [illegible] be [illegible] in the [illegible] cation and [illegible] skull. The mouth [illegible] plugged [illegible] soaked in the fluid [illegible] with the fluid. [illegible] rubbed liberally [illegible] bandaging, will [illegible] drying.

It will be found [illegible] apportioned [illegible] often be [illegible] stances [illegible] lips or side of the [illegible] section should [illegible] sometimes [illegible] perhaps to [illegible] with practice on [illegible] joints and to stop the injection of an extra [illegible] the fluid has [illegible] well from the arteries [illegible] capillaries and back into the veins.

W. L. M.

Publications of Smoke Investigations. *Bulletin* ix, 1914, pp. [illegible] Mellon Institute of Industrial Research and School of Specific Industries, University of Pittsburg, Pa., U. S. A.

The Influence of Smoke on Health. The University of Pittsburg [illegible] U. S. A., has been enabled by the generosity of Mr. R. B. Mellon to carry out an investigation into the smoke problem, and the Mellon Institute of Industrial Research and School of Specific Industries has brought out nine bulletins dealing with various aspects, such as the [illegible] and the meteorological, of this subject. The [illegible] bulletin (1914), edited by Professor Oscar Klotz and Dr. W. [illegible] is devoted to the [illegible] of smoke on health and consists of a [illegible] of the literature on [illegible] subject by Dr. Cohoe and of a number of papers. Although it has been popularly thought that smoke does not act [illegible] on health, practically all serious workers agree that it [illegible] [illegible] the severity and mortality of acute diseases of the respiratory tract, [illegible] part due to lowering of the [illegible] resistance. As [illegible] tables show that a most striking feature [illegible] the mortality rate from acute respiratory [illegible] activity and the consequent [illegible] by smoke of the respiratory tract. In Pittsburg there is an extremely [illegible] of pneumonia, the distribution of which in the wards of that city corresponds in a remarkable [illegible] with the smoke content; further, there is a noticeable similarity between the total pneumonia [illegible] and the total number of smoky [illegible] and it is possible that [illegible] invasion is facilitated by irritation of the mucous surfaces by foreign substances (White). The deposit of carbonaceous material on the lung tissue (anthracosis) which

[illegible] ocytes leads to [illegible] ative lymph [illegible] solution of [illegible] ing On the [illegible] k to pulmonar [illegible] has been [illegible] appears to be [illegible] smoke has any [illegible] ful one In t [illegible] s in which the [illegible] s is either cut off pressure or is active [illegible] ndation and stimulus to fibrosis and [illegible] the local union of the tuberculous [illegible] ar spaces (Hayhurst) Hillman con- [illegible] of soot, in which he shows that soot [illegible] due either to absorption of moisture [illegible] probably to the action of its contained [illegible] On the other hand soot as it occurs [illegible] a transparent coloring for objects and [illegible] from the destructive action of sunlight [illegible] tions of anthracosis Klotz points [illegible] the carbon is fairly uniform in the [illegible] is considerable variation in the [illegible] the interlobar and diaphragmatic [illegible] and the grooves produced by the ribs [illegible] anthracosis alone does not appear [illegible] pulmonic adhesions

H D R

Mossman [illegible] of Aplastic Anæmia, *Irish Jour M* [illegible]

Aplastic [illegible] is regarded as a form of pernicious anæmia in which [illegible] fails to respond to the call made upon it to regenerate [illegible] and of hyperplastic As a result the disease [illegible] any evidence of regeneration of the red blood [illegible] an absolute decrease in the number of the granular [illegible] manufactured in the bone-marrow In this paper Mossman [illegible] summary of the subject and argues in detail against [illegible] special form of pernicious anæmia He has analysed [illegible] cases of them including a necropsy which has usually been [illegible] to this diagnosis though he believes that the clinical features of the blood and symptoms are so typical that a diagnosis can be made with certainty during life The disease is essentially a disease of adult life and is rather more frequent in males The course is rapid rarely more than a few weeks to one or two months and remissions have been noted in one case only An especially characteristic feature is the tendency to subcutaneous or mucous hæmorrhages The color index is low rarely above unity and may be higher than in other forms of anæmia The serum remains with a low rather than a high colour index but pathognomonic stippling poikilocytosis anisocytosis and nucleated cells are absent Leucopænia is pronounced as well seen in the plastic anæmia produced by benzol poisoning There is an absolute decrease in all granular leucocytes (8 to 40 per cent of all forms) and a relative increase of the lymphocytes There is complete and total aplasia of the red marrow so that its place is taken by fat in which few cells are discernible

Against the generally accepted view that aplastic anæmia is pernicious

[illegible] to which th[illegible] [illegible] gests that [illegible] evidence of th[illegible] part of [illegible] as is shown [illegible] of [illegible] [illegible] attached [illegible] to hyp[illegible] [illegible] such as [illegible] jection of [illegible] [illegible] serum. Hæm[illegible] [illegible] perimenta[illegible] [illegible] report [illegible] the aplast[illegible] [illegible] due solely to changes in the [illegible] the resistance of the red [illegible] [illegible] or pernicious anæmia [illegible] the chief [illegible] [illegible] which is the total lack of [illegible] at the [illegible] formation [illegible] [illegible] and other morbid changes [illegible] experimental hæmolytic [illegible] the [illegible] the marrow may be the [illegible] (hæmolytoxin) [illegible] According to [illegible] corpuscle [illegible] therefore of all the [illegible] was at once [illegible] paralysed at once [illegible] course of the [illegible] would be a few days only but some [illegible] must be resistant or less [illegible] acted on by the toxin. [illegible]

H. D. R.

[illegible] Recent Studies in the Pathology of Thrombo-angiitis Obliterans. [illegible] *Research* [illegible] and *Surgery* [illegible] 1914, November.

Th[illegible] almost exclusively [illegible] emigrants and the children of immigrants from Poland [illegible] During the last eight years [illegible] has seen 200 cases [illegible] and [illegible] Weber has described cases under the title [illegible] from the East End [illegible] to a certain [illegible] cigarette smoking. The clinical manifestations are [illegible] (intermittent claudication or [illegible]) [illegible] of the leg [illegible] pallor of the leg when elevated [illegible] toes and gangrene of the extremities. [illegible] syphilis [illegible] Raynaud's [illegible] obliterans [illegible] [illegible] obliterans [illegible] found that the [illegible] of the leg [illegible] extensive [illegible] [illegible] of the [illegible] [illegible] of the [illegible] [illegible] from [illegible] the deep [illegible] [illegible] [illegible] leading to [illegible] with [illegible] on the part of the [illegible] [illegible] thrombus [illegible] occur in the [illegible] foci which seem to [illegible] giant cells but do not contain tubercle bacilli [illegible]

[illegible] endothelioid cells [illegible] tinos [illegible] should form blood [illegible] ing to [illegible] fibrosis and heal [illegible] tissue [illegible] tissue. The [illegible] is [illegible] pitches of [illegible] phlebitis [illegible] is also seen [illegible] and assist in [illegible] ambulatory occlusion [illegible] features. The [illegible] suggests [illegible] has not [illegible] photomicrographs [illegible]

H. D. R.

Cholera (I. W. [illegible] Vibrio and the Cholera Vibrio outside the Human Body. *Journ. of Hygiene*, Vol. [illegible], 1914, vol. xiv, No. 3.

In Calcutta, [illegible] it was found that the cholera vibrio must [illegible] for six to eight days during the cold season (the month of December [illegible] February) but that in the hot months (April [illegible] August) this was greatly reduced. All the observations [illegible] pointed to the danger of spreading the disease by means of [illegible] waters and not as is usually believed by water-carriers.

Gaul recommends as a prophylactic measure in times of epidemics that water should be made feebly acid. This causes the death of the vibrios. Ten grammes of vinegar to a litre of water (1 per cent.) will sterilize it in ten minutes.

P. W. B.-S.

Vialli (U.). Sur la Pathogénie du Choléra. *Comp. Rend. Acad. Sciences*, 1911, tome clii, No. 23.

By experiments on rabbits and dogs the author showed that the presence of bile plays an important part in the production of cholera. He found that a virulent cholera culture introduced directly into the intestine did not cause cholera; that an increase or decrease of the pancreatic secretion had no effects in causing the disease; but that obstruction of the common bile duct and injection of a cholera culture into the intestine below the pancreatic duct caused a typical attack. He also found that when cholera toxin was injected intravenously the secretion of the bile was diminished, and that after such an injection a cholera culture was introduced freshly into the intestine below the pancreatic duct cholera was produced. He concludes from these that a proper secretion of bile is the chief protection against cholera.

P. W. B.-S.

[illegible] cholera vibrios have been found [illegible] in the gall-bladder [illegible] [illegible] bodies [illegible] bacilli.

Dimitrius. Adrenalin und Cholera. *Inaug. Diss.*, Basel, 1911.

The author discusses his experience of the action of adrenalin in an epidemic of cholera. He treated 166 cases with 2 mg. intravenously or 3 to 5 mg. subcutaneously. In these there were only forty-six deaths, or a mortality of 26 per cent. In a control series of 110 cases treated by ordinary routine methods 60 per cent. died. It is noted that in neither series of cases were hypodermic injections or anti-cholera sera used.

P. W. B.-S.

Statistics of Inoculation in Greece, Public Health Reports, [illegible] No 30

In the Greco Turkish War no cases of cholera occurred in the [illegible] but in the Greco Bulgarian campaign cholera was very prevalent About 500 000 people were vaccinated in Greece in accordance with the method of Kolle The incidence among the uninoculated was 93 per 1 000 and amongst those inoculated once 42 per 1 000 and amongst those inoculated twice it fell to 27 per 1,000 The case mortality also showed a great reduction in the inoculated, for the uninoculated it was 77 5 per cent for those once vaccinated 12 2 per cent and those twice vaccinated 10 2 per cent P W B S

News of the Service

THE NAVAL MEDICAL SUPPLEMENTAL FUND

It is [illegible] to the account of the history and objects of this Fund was [illegible] by an original Act of Parliament governing the Fund was [illegible] the initial work of transforming its administration could be [illegible]

Medical officers will be interested to learn that the Act has now been repealed by [illegible] and the Management and Rules will be printed [illegible] [illegible] Queen's Regulations and Orders Copies will be placed [illegible]

[illegible] proposal should grants in aid [illegible] the Fund the Lords [illegible] that the subscription [illegible] [illegible] and that the benefits should be [illegible] as follows [illegible] [illegible] With the [illegible] an amplified [illegible] [illegible]

PROMOTIONS

Right [illegible] MB FRCS Surgeon RNVR promoted to Staff Surgeon RNVR [illegible] 1911

Edward J [illegible] MB Surgeon RNVR promoted to Staff Surgeon RNVR [illegible]

Harry R [illegible] MB Surgeon RNVR promoted to Staff Surgeon RNVR May 11 1911

William [illegible] MD Surgeon RNVR promoted to Staff Surgeon RNVR August 1911

Robert [illegible] MB FRCS Surgeon RNVR promoted to Staff Surgeon RNVR March 1911 The war special promotion for services [illegible]

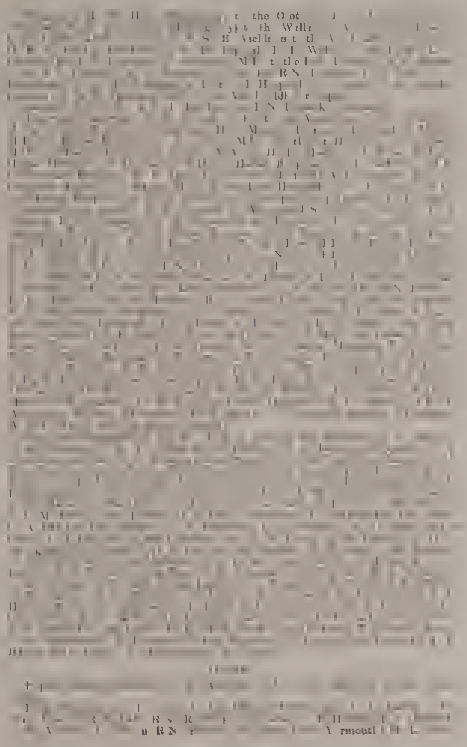
[illegible] MB Surgeon RNVR promoted to the rank of Honorary Surgeon March 1911

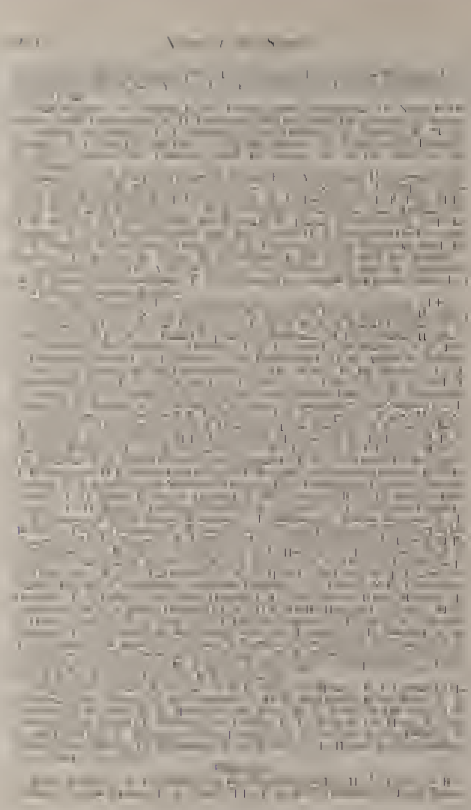
APPOINTMENTS

Dreadnought

Staff Surgeon [illegible] H Jones to the hospital ship Aguila H C Arthur to Naval Barracks

Staff Surgeon W B Smith to the Africa A Davidson MB to Pembroke [illegible] Staff Surgeon [illegible] Smith to the Victory additional for disposal R Kennedy to the Egmont [illegible] W Bassett to the Victory additional for disposal A Davidson MB to the Naval Base W R Hutton to the Inconstant [illegible] A Smith to the Victory [illegible] Defence Sick Quarters





Depot, Deal, J Bradley to Portsmouth Dockyard, A S G Bell to the Laurentic, M J Smith M D, F R C S to the Victory addl for disposal J F Hall M B to the Vivid addl for disposal, E D J O'Malley to the Pembroke addl for disposal, E C Sawdy to the Vivid addl R Hudson R N (Retired) to R N Division Blandford, E D J O'Malley to the Victory addl for disposal; W W Kon M B to the Warspite; R W Stansfeld to the Pembroke addl for disposal.

Staff Surgeon E R Beckford to the Pembroke addl; C K Peake to Bathurst W T Stallan, G H S Mills, M B (Emergency List), to Chatham Dockyard, T H McDowall to the Indus, T F Blunt to the Opihia, N B V Jacob to Easterbrook Australian Station, N B V Jacob to Foreign Air Craft Base, H V Wells to Easterbrook Australian Station, J G Wallace to the Victory addl for disposal, H L Cunningham, M B, B A to the Victory addl for disposal, R Hughes to the Pembroke addl for disposal, R R Healey to the Royal Arthur; R. H St. B. B. Hughes to the Swiftsure.

Surgeons C D Macintosh to the Victory addl for disposal, M P Fitzgerald, M B to the Victory addl for disposal, R E. P Sayers to the Victory, addl for disposal, F W Quirk to the Vivid, addl for disposal, H R B Hull to the Barham, Chinese G L D Ellis to the Warspite, B E. P Sayers to the Princess Margaret, W A S Duck to the Barrets, A Franky to the Onslow, T C Patterson M B to the Vivid addl for disposal.

Staff Surgeons R N V R W Allen to the Vivid addl for disposal; A R Bradley M B, I R C S to Haslar Hospital.

Surgeons, R N V R W R. Blenkin to the Lombroke addl, T Turner, M P, to be Surgeon and Agent at Pembroke, T J Skeggins to the Pembroke, addl for disposal, T D McEwen M B to the Pembroke addl for disposal.

Temporary Surgeons A C Mc.ney M F to Royal Marines Deal, C M Orkloe to the Princess George, D R Patell Sevikhi M B to Haslar Hospital, G S Aspinall to Haslar Hospital, W B Cunningham M B to Chatham Hospital, W L Clegg, M B to Gosport Hospital, N K Stewart M B to the Vivid addl for disposal, D S MacKnight to the Vivid addl for disposal, C C. Rankine to Wormwood Scrubbs R N Air Station, E Heffernan M B to Wormwood Scrubbs R N Air Station, J N Gordon M B, to Wormwood Scrubbs R N Air Station, J A Thompson to the Swiftsure, F Francis to the Britannia, V E. Ibis M B, F R C S, to Haslar Hospital, H F Margetts to the Victory addl for disposal, A McM Hay to the Agincourt, W E Lax to the Laurentic, H Wilk to the Lombroke addl for disposal, W Hogg, to Wormwood Scrubbs R N Air Station, A R. Upton to Chatham Hospital, J D J Hurst to the Victory addl for disposal, J N McK Ross M B to the Lombroke addl for disposal, F Masters to the Swiftsure, F H Rees to Hyderabad Hospital, S Wentworth to Haslar Hospital, H to Master to Haslar Hospital, T Mitchenson to Hospital Ship Britannia, W K Rhodes M B to the Agincourt, N S Wilson to hospital ship Britannia, W Hanley F R C S to hospital ship Britannia, V C Stewart M B to the Medway, E J Fairgrieve to Indus, J F McCausland to the ship, R Flack to the Hospital Ship, H W Simpson to the Lombroke addl, T Widdrington to hospital ship Britannia, R W Lawson to the Vivid addl for disposal, W Bell M B to the Vivid addl for disposal, F A Williamson to the Warspite, R S Lawson M B, to the Zambesi for disposal, to Dockyard, Devonport, A J Hale M B, I R C S, to be attached to the Britannia, B Malcolm to the Vivid, Allan J Semple to the Victory, H C Mant R N, Duty Hospital Chatham, J S Farmer R N, Hospital Haslar, P L Cox to R N Barracks Deal.

Surgeons Lieutenants R N V R J Sproston to the Minerva, R N Medical Supply Depot, R Cunningham to Medway, J S Mitchell to the Victory, for disposal, to the Stanley, T L Thorburn to the Pembroke addl for disposal, A Ardern to the Victory for disposal, to the Britannia, to the Medway.

OBITUARY.

Since the last number left Journal we regret to record the following deaths of members of the Medical Service:—

Those who have been killed in action or died of wounds received in the present war have been:—Victor and Clan M Sadler, Lt. Andrew Leith Hay, Agius, the Atlantic during, and six months have left.

The war from the Government has created a great number of Surgeons, allegations against Lieutenants, officers have been lost, we are proud that most of us have done the duty, nothing work performed by them.

Killed in Action

Fleet Surgeon Geoffrey Taylor B A , M B , was the Senior Medical Officer of the Formidable when she was sunk by the Channel by a German submarine on January 1 1915 and he went down with his ship

He was educated at Dublin University taking his B A in 1895 and his M B B Ch B A O in 1897 After holding the post of Resident Medical Officer of the City of Dublin Hospital he joined the Navy in November, 1897, and served in the Mediterranean Home Fleet (three times) Channel Squadron Atlantic Fleet and the Surveying Service in the Pacific He was appointed to the ' Formidable ' in October 1913

Surgeon William Nearns M B was lost in the ' Formidable ' when she was sunk by a German submarine on January 1 1915 He was a graduate of Aberdeen University M B Ch B April 1908 and entered the Navy in November 1908 After serving in Home Waters for nearly two years he was appointed to the Red breast to the East Indies Subsequently he commissioned the ' Teal ' a China river gunboat He joined the ' Formidable ' a few days before war was declared He represented his University at Rugby Football for the last two years of his student s career He was a good swimmer and an all round athlete

Surgeon Septimus Herbert, R N V R., was lost in the ' Formidable ' when she was sunk by a German submarine on January 1 1915 He was educated at University College, Oxford, and St George s Hospital and graduated M A , M B , B Ch in 1913 He joined the Royal Naval Volunteer Reserve in August 14 1913 but was not called up until the outbreak of war when he was appointed to the ' Formidable ' He held the posts of House Physician House Surgeon and General Assistant at St George s Hospital He was a good athlete and musician and won the mile at many athletic meetings at his University, and the Sussex County Amateur Championship

Lost at Sea

Surgeon Vernon Lechfield Matthews was in medical charge of H M S Viknor —an armed merchantman—when she was lost with all hands in January He was educated at the London Hospital and obtained his M R C S , L R C P , in 1906 After holding the appointments of House Surgeon and Anæsthetist at the London Hospital he became Clinical Assistant to the medical out patient department at the Hospital for Sick Children Great Ormond Street He entered the Navy in May 1911 obtaining the first place in his ' batch ' and winning the Gold Medal and Locket Case His first appointment was to the ' Drake,' Flagship in Anglesea and after paying her off he went to Eastney Barracks He joined the Viknor in November, 1914 He was a good cricketer and played for the Navy against Hobart in 1912

Staff Surgeon Walter Graham Moore Anderson M B , B Ch , B A O was in medical charge of H M S " Clan McNaughton " —an armed merchantman— when she was lost with all hands in January He was educated at Trinity College, Dublin and taking his degree in 1903 filled the post of House Surgeon at the Adelaide Hospital Dublin In 1905 he entered the Navy He was a very good all round athlete and while serving in the Impregnable (training ship) did a great deal in working up the boys enthusiasm for manly games and sports During his three years in the ' Servia, ' he was present at no less than three presentations at Bath Nicaragua and Honduras and he was complimented on the wonderfully good health enjoyed by the ships company at the ' Servia ' in a very trying climate Only last July Staff Surgeon Moore Anderson at 37 years of age gained the silver cup presented to the winner of the Officers Flat Race in the Queenstown Training Service He was very musical and his sketches were charming A more gifted and popular officer it would be hard to find

Surgeon Probationer Raymond O Connell Redmond R N V R. was also serving on board H M S " Clan McNaughton " when she was lost with all hands in January This promising young officer is descendant of Daniel O Connell ' The Liberator ' — was only 21 years of age He was educated at the Royal College of Surgeons of Ireland and the Richmond Hospital, passing his third professional examination in March 1914. He gained first class honours in Anatomy He was a good cricketer and hockey player

Notices.

The Editors invite Medical Officers to send in Original Papers on professional subjects, travel, personal experiences, &c. Items of news and matters of interest to the Naval Medical Service will be welcomed from ships and establishments on home and foreign stations.

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25	4	0 3 0	0 1 3	1 0		1 9		0 4	0 9
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100	4	0 6 6	0 2 6	2 6		3 3		0 6	1 0
	8	0 8 0	0 4 4						
	16	0 16 9	0 6 9						
200	1	0 3 6	0 1 6	2 0		2 6		0 6	1 0
	8	0 16 6	0 6 0						
	16	1 3 0	0 8 6						

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